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ABSTRACT

This report attempts to analyze the contributions of the educational system and job training programs to industrialization and technical progress in the Conubal zone of the Lower Balsas River of Mexico. The first of the study's three sections consists of two chapters that provide general background. Chapter 1, "Theories of Development and the Role of Education in Progress," presents perspectives on the role of education according to distinct concepts of development, as well as mechanisms of action favoring technical progress and innovation. Chapter 2, "The Educational System in Mexico," describes the structural characteristics of the system, its evolution and the place of technical education in the general program of the government. Comprised of five chapters, the second section of the study deals specifically with the Conubal zone of the Lower Balsas River. Chapter 3, "Industrial Development," analyzes the present characteristics of the production structure in the zone, as well as its assumed development strategy. Chapter 4, "Agrarian Structures in the Conurbation," looks at the general characteristics of rural areas in two subregions (coastal and mountain), the uses of soil, units and types of production, technology, organization of the work, use of credits, and trade. Chapter 5, "Population Structure and Dynamics of the Population," describes the evolution of the populations of the five municipalities that constitute the Conubal zone, with special reference to trends in urbanization, the composition of the economically active population and its composition by age and sex over the period 1930-1980. Chapter 6, "The Formal Education System," analyzes the situation previous to the expansion of the poles of development and the dynamics introduced by the emergence of industry and tourism. Chapter 7, "The Micro-region of Lazaro Cardenas: Estimates of Human Resource Demand," concludes the second section, with calculations of the various human resource demands generated by the industrial activities of this region. The third and final section of the report, "General Summary and Conclusions," discusses the implications of analyses, theories and plans pertaining to the Zone, and proposes general suggestions for the design of an educational policy for the region, as well as unanswered questions that must be answered in future treatments of the subject. Numerous tables of data are included in five appendices. (DB)

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IIEP Research Report No. 59

Education, industrialization and technical progress in Mexico

by Jorge Padua

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International Institute for Educational Planning

Education, industrialization and technical progress in Mexico

This study is part of the IIEP research project on 'Education, industrialization and scientific and technical progress', directed by Ratchik M. Avakov

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Jorge Padua

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Education, industrialization and scientific and technical progress : an IIEP research project

In drawing up its Medium-Term Plans, the International Institute for Educational Planning selects a series of research fields that correspond to factors directly connected with the current state or the future of educational systems and, consequently, with educational planning. The latter is considered as a process of information, consultation and forecasting, leading to decisions and to strategies to implement them.

These research projects and programmes are based primarily on empirical observation of contemporary phenomena in our societies. Their findings are translated into teaching materials directly usable by the IIEP to meet the needs of the various participants in its numerous training programmes. These programmes are attended exclusively by officials with responsibility for the administration of educational systems.

One of the research themes contained in the Institute's third Medium-Term Plan (1979-1983) was the 'Contribution of education to industrialization and technical progress'. As is its custom, the Institute carried out a number of country-wide studies in certain Unesco Member States. As usual also, the studies were conducted jointly with research teams in the countries concerned.

This research theme, which has been the subject of several national monographs, was selected because of the need for deeper insight into the nature of the relationships that have grown up between education—in its various forms and at its different levels—and the structural and functional changes brought about by technical and industrial development in the societies under study. Attempts to deal with the complex conditions and consequences of these relationships raise a number of questions :

- have sufficient skilled personnel, in addition to material resources, been made available to sustain technical and industrial progress?
    - if so, what kind of channels of communication have been established between educational systems (formal and vocational training, both outside and inside the enterprises) and centres for the application of scientific research and industrial development, and what kind of 'messages' have been travelling through those channels?
    - if not, what are the obstacles or difficulties that account for the absence or imperfection of the 'messages' and 'channels' between these two poles?
- What is the nature of the technical and industrial challenge facing education?
- What are the educational constraints restricting industrialization and technical and scientific progress?
- How ought the mechanisms and methods of planning respond to these issues?

The answers to these main questions and to all their subsidiary questions are important in both theoretical and practical terms.

In theoretical terms, because these answers could very well open up a broad panorama clarifying the place of education in technical progress. This would permit more detailed and in-depth interpretation of their relationships as elements of a system, enabling researchers gradually to identify the role played by these phenomena in the development process. In practical terms, because this kind of conceptual approach ought to yield fresh data throwing new light on the kinds of changes required in educational and training systems. In turn, this should help to bring into sharper focus the points or areas requiring adaptation, to which the educational planning process is supposed to respond, while simultaneously improving its techniques in order to render the process more effective.

The original intention behind the IIEP's decision to launch a series of case studies was to situate the problems to be examined within the practical context of various national contexts. This was expected to permit verification of the general working hypothesis, which was formulated thus : (a) the intensity, forms and mechanisms of the relationships between education/training and industrial and technological development, being a function of the national context, vary from one country to another; (b) these relationships share a number of common points and features independently of their socio-economic, scientific and technical, and cultural characteristics. The question, therefore, was to identify both those features that are specific to the different countries and those that are common to them in this particular field.

Studies were therefore launched to verify these hypotheses in several industrialized countries—notably in centrally-planned ones—and in certain developing countries. Some case studies have covered the entire range of problems facing a given country (i.e. Hungary, Portugal the German Democratic Republic, Sudan, Czechoslovakia, Togo, Tunisia and the USSR). Others dealt with international comparisons (i.e. 'Education, technical progress, industrialization: the experience of the socialist countries'; 'Higher education and employment in the USSR and the Federal Republic of Germany'). Lastly, a series of monographs focused either on one area of a Member State (i.e. Soviet Azerbaidjan, the Rio Barras Delta Development Zone in Mexico) or on a particular sector of a country's economy (for example: Technological change and the production of skilled manpower in the Cuban sugar industry).

The research findings published in the present volume are part of the overall research carried out on this theme and made available by the IIEP to educational planning practitioners and the international educational research community.

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INTRODUCTION

I. Two dimensions of the problem

International organizations and the educational community have justifiably affirmed that in order to overcome underdevelopment, the countries of the THIRD WORLD must confront simulaneously three or four of the revolutions that took place in sequence to configurate what is now known as the First World: the agrarian, the industrial, the bureaucratic-organizational, and the scientific-technological. Whether or not one agrees with the type of transition, or with the necessity, or even the possibility, of simultaneous occurrence, what is certain is that the four revolutions constitute the fundamental structural elements which on a global level have determined the dependence or independence of nations. Such an affirmation emphasises, at the same time, the interrelationships existing between the various sectors of the economy and the organizational levels, as well as those processes which link the dynamics of innovation and productivity.

The title of this project related education and training systems to industrialization and technical progress; we will focus within this general context on the relationships between organizational systems and the productive apparatus. The central theme of the study is development, and within that, the contribution of the educational and job-training systems to industrialization and technical progress.

We are dealing with themes that are broad, complex, multifaceted, and controversial. Disputes and polemics amongst specialists concerning fundamental assumptions and appropriate strategies are abundant and cover the whole range of economic, cultural, social, and political phenomena and processes that will be dealt with here.

Fortunately, our problem is a regional one, and the region concerned has been the object of numerous studies, especially as regards the industrial "pole of development". We will take advantage of these to formulate several working hypotheses. Especially useful to us have been the studies elaborated by and for the Technical Committee on Human Resource Planning of the Ministry of Public Education of Mexico in conjunction with the Ministry of Labourand Social Welfare(1). Also of particular assistance were the investigations of El Colegio de México on the steel industry, and we ourselves have undertaken studies of the agrarian structure of the zone.(2)

We have adopted two perspectives in this study. The first is a positive-descriptive one, presenting data and information about the principal and specific characteristics of the zone, its dynamics and its prospects. Some of the most important variables in a study of this nature are population, agrarian and industrial structures, the systems of formal education, and training mechanisms. We have dedicated a chapter to the characteristics, structure and evolution of the formal educational systems in the country as a whole.

The second perspective is a normative-evaluative one, concentrated mainly on the interpretation of tendencies and processes, and seeking to analyse government programmes on both the regional and national level. Although an attempt is made to separate these two perspectives, both are present in all the sections and chapters of the study, the first more noteworthy in describing the operation of systems, the second in discussions of planning and strategy.

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(1) Especially
- El Proyecto del Puerto Industrial
- Demanda de Recursos Humanos
- Determinacion y Analisis de los Factores Condicionates de la Demanda
- Oferta de Servicios de Capacitacion y Adiestramiento

(2) See Zapata, F. et al. 1978. Las Truchas. Acero y Sociedad en México. El Colegio de México.
Godau, R. 1982. Estado y Socieded. Historia Politica de Las Truchas. El Colegio de México.
Minello, N. 1982. Las Truchas. Historia de una Empresa. El Colegio de México.
Bizberg, I. 1982. La Accion Obrera en Las Truchas. El Colegio de México.
Padua, J.; Pucciarelli, A. & Zapata, F. 1981. Recursos Humanos y Organizacion de la Comunidad en la Zona Conuerbada de la Desembocadura del Rio Balsas. OCTD/CONURBAL, México
Pucciarelli, A; Zapata, F, & Padua, J. 1982. The Dynamics of Reality in Lazaro Cardenas: Labor Force Participation and Economic Activities. Paper presented at the 10th World Congress of Sociology, México.

The orientation of education and training toward industrialization and the orientation toward technical progress are described, interpreted and analysed separately.

(a) Education, training and industrialization

The conurbation is a region of "explosive development", the product of the Mexican States' strategy of developing industry and tourism in association with national and transnational capital. A region that no more than ten years ago had little or no activity in the secondary and tertiary sectors of the economy is suddenly subjected to powerful investment (thousands of millions of dollars) and a headlong transformation not only in its structures of production and employment but in the volume and structure of its population (from a rural to an urban area from an "expulsion" to a net "importer" of population). The industries established there, and those planned for the future, are directed at markets external to the region, to national and international markets. The principal concern is with the production and productivity of capital-intensive industry operating on the basis of advanced technology, functional in its inputs to the national and regional economy and in accordance with industrial complex' strategies competitive on the international level.

This analysis is made simpler by the fact that a clear industrial development strategy, whether it is the best conceivable or not, has been set for the region. Enterprises are more or less precisely identified, the type of technology and volumes of production are determined in detail through in-depth studies of the alternatives deemed most favourable. Calculation of necessary 'key' human resources is less complicated, and experience accumulated on the national and international level is extensive. The problems that arise now are qualitative and those related to the risks of error in the estimates, which can arise from the timing of investments, the dynamics of the structuring of the enterprise in its interchanges of input-output, and the flexibility of the national and international markets in the acceptance of the products; in summary, in the macro- and micro-economic factors that define the 'true and correct' path of the particular strategy for industrialization.

What we see in the planning of the region is in fact a public policy strategy that favours industrial growth over agricultural; investment in the urban sector over the rural, and encouragement of capital-intensive technology in preference to labour-intensive enterprises.

The complex industrial production established and developing in the Industrial Port has specific requirements for professionals, technicians and skilled workers. The problem of what is "adequate" (capital-intensive or labour-intensive) fades away, and the formal education and training systems play critical roles affecting everything from the possibilities of production to the critical problems of productivity. On the specific level of the actual factories that produce boilers or fertilizers or products of any other transformation industry, problems have to do with the attraction of knowledgeable experts, and with the training of those that have enough educational background to assimilate specific skill-training fairly quickly. A civil engineer or a doctor or a business administrator cannot be turned out in two or three years; it takes five to seven. Once the occupations and professions that fill the requirements of growth in productive activities are identified, the forecasting of short- and medium-range needs is indispensable for the micro-region of Lazaro Cardenas; we know that the educational needs will be higher by the nature itself of the complex industrial organization.

The human resources needed in the medium and long run have been projected by technical organizations that have given some attention to these processes, which are to some extent useful instruments in helping reduce arbitrariness, in the resolution of specific problems and in the tasks of planning and control. The majority of the models that have been used are derived from the branches of applied economics; the calculations were heterodox in the sense that they sought combinations of techniques of estimation that include surveys of employers, international comparisons, and methods of fixed coefficients.

The models also consider variations in the composition of employment, a product of the fluctuations and rhythms in the establishment not only of new industries in line with programmes anticipated by the authorities of the Industrial Port, but also of those that emerge as the infrastructures and construction of industrial projects dwindle and industrial activities are intensified. Thus during certain stages of the process of industrialization in the micro-region, both unemployment and scarcity of human resources occur at the same time - unskilled workers are unemployed because of the diminishing activities in the construction industry, and highly skilled manpower is unobtainable because of the intensification of activities in the industrial sector. Implications for education and training strategies are obvious.

The models available for the calculation of human resources have been the object of criticism, which was usually justified, related to four types of questions:

- those associated with the theories and methods used in the estimation of resources;
- those related to the abstract character of the models and the limits which reality imposes on them;
- those that refer to general, global or sectoral strategies for development;
- those that deal with the tendencies to ignore the central processes of education (one speaks of input-output, supply-demand, etc., without referring to the processes that occur within the educational system).

If the analysis was simple in terms of estimation of the demand from the industrial sector and the educational potential given the tendencies of the formal educational system, it is now complicated by these four questions and by others that arise in relation both to development strategies and to the roles of formal education in the various possible strategies.

One of the problems, for example, has to do with the availability of theoretical bases that relate development theories to educational theories and the consequences in specific programmes of action. In our analysis of Latin America we describe not only the relative advances in the area, especially the contributions made in recent years, but also the problems that educational sociology and the economics of education, relatively new disciplines, face in coming up with technical solutions. Although we deal with the problem as it concerns Latin America, this part of the diagnosis seems to us valid even for developed countries.

Specific regional and local problems arise from the point of view of both general statements of the aims of development, and specific strategies for achieving it. In the case of the conurbal zone of the Lower Balsas River, the beginnings of "regional development" are spoken of; later on, the same government agencies attempt to focus the problem from the perspective of the development of the micro-region of Lazaro Cardenas, shifting in this way the objectives and priorities. Agrarian and industrial structures are analyzed, and a type of logic of development is detected; the rural is subordinated to the urban, and the agrarian to the industrial, in a model that focuses development on a micro-region and ignores the overall region. The "laws" that modulate their development or stagnation are different, both in their rhythms and in the results foreseen in the short and medium term. The mountain regions, still indifferent to the always indirect stimuli (positive) that they receive from the poles, require a strategy different from that put forth for the industrial poles.

(b) Education and technical progress

The second of the dimensions related education and training to technical progress. Treated separately for analytical purposes only, it is closely related to the first dimension by its somewhat more complex and normative sense, arguments centring around such themes as innovation, originality, the relationship between science and technology, and the qualitative links between the educational system and the productive apparatus.

It has been demonstrated that industrialization -- a special type of industrialization -- is possible even under conditions of economic, political, cultural and technological dependence. It is possible to put together an industrial machinery capable of making everything from soap to steel, petrochemicals, automobiles and textiles, by importing technology, technological packages, or even entire factories with the key professionals included in the "package". This is in general a dependent industrialization, associated with "enclave" economies and not conducive to development and technical progress. Local human resources need not have more than minimal education, and their educational profiles are quite unlike those of their occupational counterparts in developed countries. In terms of the dynamics of production, productivity, and innovative processes, however, the results are open to question.

The recognition that technology is one of the key elements in development and that it is necessary to strengthen programmes for overcoming the problem of technological dependence has become commonplace, especially in the past two decades, in international circles and in national and regional public and private agencies. The Latin American countries are perpetuating their status as consumers rather than producers of technology.

The transformations proposed for relating the educational system at all levels with scientific and technological activities have been numerous and have come from different sources - on the one hand by those that are sceptical about the innovative capacity of the institutions (educational and economic) and prefer strategies tied more to the basic necessities of the population, emphasizing the informal sector of the economy, and on the other, by those that place upon the educational system the sole responsibility for resolving problems through its supposed rôle as an agency of preparation of the labour force. Between the extreme statements that "education is not good for anything" and "the school solves all the problems" is a set of attitudes that try to decipher the role that the formal and informal educational systems play in these complex processes.

We accept the following propositions:

1. increases in production and productivity are closely associated with the dynamics of technology and of technological changes in the productive apparatus;
2. the strategies of maximization of yield and generalized efficiency in the exploitation of resources and the organization of work require the effective use of technical skills at all levels;
3. the phases of development associated with the growth and strengthening of productive activities on a large scale require a re-accommodation both in the structure of the economy and in the presence of a labour force with specific qualifications and technical skills;
4. education is one of the key agents for stimulating these processes;
5. educational strategies will be different for strategies of labour-intensive industrialization than for strategies of capital-intensive or technology- and skilled-labour-intensive industrialization;
6. the overall dynamics of these processes requires institutional frameworks that direct the benefits of new strategies meaningfully and tangibly toward the principal agents involved in the total process.

However, even accepting the above propositions, it remains to resolve the now more specific problems of where we are, where we are going, and, having taken the decision to promote change, how we will do it. As to technologies and reforms it is recognized that decisions are occasionally taken more on the basis of political interests and idiosyncracies (such as corruption and bribery) than on technical criteria or criteria of productive efficiency.

II. Type and style of education

Every educational system develops human resources, all of them socialize and indoctrinate. The problem is in deciding what type and style of education to adopt; what purpose it shall serve; how different styles shall be combined for different social groups. One of the major controversies concerning the role of education in development, in industrialization, in technical and social progress and change, has revolved recently around the relationship that exists between educational cost and its consequences in individual and social terms, and in polarized versions of order and control, of micro- and macro-analysis, of emphasis on human resources or the effects of social stratification and class on socialization and indoctrination. Some desagreements and tensions between schools of thought are due to different ontological assumptions about the nature of man, of mind and of society. Some are due to the fact that in a strict sense, education is not a discipline but draws on many disciplines, mainly philosophy, psychology, sociology, economics and history; disciplines with their own standards, approaches, emphases, schools, and "visibility" vis-à-vis the power structure in the processes of decision-making. Furthermore arguments and polemics reflect both the poor state of knowledge in economics and the social sciences and the different interests, conceptions and values that in the name of the plan and of science are used to represent different ideologies and conceptions. Power and politics are central here, because the formal educational system is one of the government agencies which employs the highest numbers of people and obtains a major share of the budget.

The answers to the very general question of the contribution of education and training systems to industrialization and technical progress have been varied and in general contradictory.

Three issues can be percured -- all strongly related: (1) the ontological question of rationality and irrationality in human behaviour and organization; (2) the interpretation of the processes of transformation of societies; and (3) response to the need for relating educational programmes with government strategies.

1. The rationality/irrationality question

In the Western culture, the ideas that history is made by reason; that the social order is guaranteed and based on the rationality of free man; that civilization has moved, is moving, and will move toward the better are central. In Latin America the assumptions of progress, evolution, growth and development; the optimistic idea that transformations are made possible through the application of science to productive and social activities; the incorporation of techniques and methods to modernize and secularize institutions and ways of life by means of technological innovations, have been incorporated into political thought since the beginnings of decolonization in the early nineteenth century, first with Englightment, later with

19th century ideas of progress, and in the twentieth century with the strong influence of neoclassical economic theories and functional-structural theories of modernization.

Opposition to the assumption of rationality and, especially, of secularization was naturally focused in tne Church and in very conservative groups. But with time, even those groups and institutions accepted implicitly the ideas of rational man and rational society. The main differences lay in what was understood by rationality, and in preferences for various systems of thought. But since early 1970 one major rationality/irrationality controversy is taking place in the Western world, and its waves are reaching Latin America. Partly owing to the resurgence of phenomenology as a theoretical approach, partly as a consequence of a "crisis of civilization" experienced in certain "key" countries (Marcuse; minority rebellions in the U.S.A.; the movement of May 1968 in France; the cultural revolution in China; disenchantment with a bureaucratic form of socialism, etc.) a new anarchic approach emerged, proposing less rational Utopias. "Objective" theories of development and progress were denounced, and the moment was propitious: first, there were the negative social and cultural effects of industrial civilization, later scepticism of the possibility of attributing a rational character to historical processes.

The tensions in ideological terms between rationalism and irrationalism are then polarized between those who deny that rationality is possible and question the benefits of technical progress and development, and those who seek to decipher all the mysteries of nature through rationality.

In response to the challenges of the human condition, every once in a whole materialist or determinist systems arise which seek to rationalize the irrational and to reduce dynamic and creative aspects of human nature to networks of causal relationships and mechanistic reactions. Emphasis may be placed on corporal materiality or on dynamism of relationships, on substantial or functional aspects but the threat to man and to society of placing technology at the service of ideology is within spectrums that go from nuclear physics to cybernetic psychology, to the control of societies of semiautomatons manipulated by party bureaucracies or transnationals in which power loses all sense of proportion, and ethical, aesthetic and moral convictions are put in the service of causes that few are aware of. In the name of the party, the plan, or the corporation, the mysteries of our nature are revealed to us in catchwords or slogans. Systems and ideologies, which are no more than theoretical and hypothetical constructions, are presented as real. Models of order that by definition take no account of the parts being ordered, models of empty spaces; rules of language ny which structures are associated to functions or functions to structures dominate the panorama.

Max Weber pointed out that the Western idea of rationality is manifested in a material and intellectual system which, in striving for functional efficiency, tends toward a special type of domination: the total bureaucracy. Based on functional efficiency, on the principle of individual freedom and intelligent choice in its evolution, this concept of reason is transformed into its own contradiction: the antidemocracy. K. Manheim, paraphrasing Weber, expresses this clearly:

> "...Industrial rationalization served to increase functional rationality but ... it offered far less scope for the development of substantial rationality in a sense of the capacity for independent judgement ... Functional rationality is, in its very nature, bound to deprive the average individual of thought, insight, and responsibility, and to transfer those capacities to individuals who direct the process of rationalization..."(1)

Assigning to science the status of a cultural imperative beyond all question or discussion, configurations of power and technocracy are created where the highly specialized but not very competent technocrat, holds the central role in the decision-making process.

In a climate of every aggravated alientation, what solutions are open to us? The opposite extreme, lacking confidence in the renovating capacity of institutions, proposes a different kind of Utopia: regression to previous stages, anti intellectualism, glorification of the world of myths, salvation by spontaneity, generalized subjectivism.

2. The interpretation of the processes of transformation of societies

Debates concerning the interpretation of the processes of transformation of societies in Latin America and the nature of political-economic thought evolved in three stages. First there was the classical political economy described by Adam Smith in the early nineteenth century; then came the neo-classical theories which were dominant between the late neneteenth century and the middle of the twentiety century; and finally there have developed, since the 1950s the tensions described earlier between those emphasizing order versus those emphasizing control; equilibrium versus conflict; interdependence versus dependence, etc...

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(1) K. Manheim, 1940. Man and Society in an Age of Reconstruction, New York,Brace and World.

In the 50s and 60s the orthodoxies in economics were neo-classical micro-economic theory and Keynesian macro-economics. In the social sciences they were the functional structural paradigms, the analytical frameworks of classical political economy and Marxism.

Socio-economic and political models proposing change are polarized -- one extreme emphasizes the socio-political, economic and cultural transformations required for the promotion of modern industrial capitalism in the underdeveloped countries, the expansion of education, ,agrarian reform and rural modernization, accelerated urbanization, promotion of social mobility, rationalization of public administration, etc., the other points to areas of conflict and to the claim that changes can be brought only through confrontation with the aim of building a society based on socialism.

3. Relating educational programmes with government strategies

The third issue, more closely related to this research, has to do with specific strategies relating education to public policies and with the emphasis that the various disciplines ascribe to the relationship between education and its consequences in the processes of transformation. We can provisionally examine these concerns from two perspectives: that of the economist giving attention to the technical division of labour, and that of the social scientists focused on the social division of labour.

The former emphasize the human resources aspect; the latter, social inequality. With some disagreement about the capacity of the schools to solve the problems of society, both sides concur with the general public and the government planning organisms that education is relevant. There is also common dissatisfaction with the inefficiency of the forms through which the educational system operates: the system is inefficient in solving the questions on which so many hopes have been placed.

But the tensions are not limited to problems of conceptualization, What we want to point out here is the two tendencies that have developed since the 1950s and tend to be hegemonic on two institutional levels. Academia is dominated by social scientists with their criticism, denouncement-diagnoses and identification-diagnoses of the educational system. Public planning, more pragmatic than

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theoretical, uses criteria, models, schemes and diagnosis of an economistic type.

The structural changes in Latin America in recent decades have been noteworthy, as has been the expansion of the formal educational system. Education is more and more accessible to ever wider levels of society. This is a fact. It is also a fact that attempts at planning the system have both succeeded and failed to facilitate access and to guarantee completion of levels. The failures are associated with the attempts to diversity educational opportunities, to direct the flow systems, to adjust education to social needs, and to fill the requirements of the productive appartus. Research on relationships between education and income, education and employment, and so on, has contradictory results.

In terms of theoretical conceptualization, perhaps the most acute problem is how to reconcile the two sides, each of which tends to interpret the process of transformation in an incomplete way.

One side ignores basic problems, underestimates the role of political variables and the capacity of the various social sectors to put pressure on the State; the other fails to distinguish educational practice from its content, underestimates the technical aspects of the processes of transmission of knowledge in a population that by its heterogeneity (age, social and cultural condition) requires specific treatments quite distinct from the spontaneities that are derived from its postulates, and ignores or under-rates the importance of objective requirements imposed by the technical division of labour.

A more moderate discussion of the contributions of education to technical and social progress, outside of those extreme levels, forces us to propose in simultaneous terms the economic necessities of production, the ethical necessities of distribution and the aesthetic necessities of achieving a certain quality of life. Subordination of ethical and aesthetic concerns to the economic has resulted in the dehumanization of man, the depredation of the environment, the exploitation of the majority by minorities. The distribution of what one does not yet have, of what is not yet produced, brings on similar crises. The assumption of aesthetic values foreign to the culture defining what is desirable or practical has also led to alienation and disillusionment. The negation of reason and of the possibilities for change are not an attractive alternative, at least not in Latin America.

The problem is therefore not solely one of rationalizing investment, anticipating future necessities, preparing the resources necessary to cover the labour demands that are generated according to one or to the other of the various development alternatives; it is also relative to the types of education provided, to the distribution of knowledge amongst the various social groups. In this sense strategy must be much more dynamic and flexible, and respond both to technical problems of elasticity in the supply of jobs and specific positions, and to the much greater needs related to forms of participation in a changable and changing reality.

The guarantee of access to and completion of primary and basic levels of formal education is an acquired right and a political conquest; it is not necessary to look for justification such as investing for development, or meeting the changing needs of the employment structure. In political and cultural terms the fundamental objectives of education are found in the social and cultural democratization of the population; in the availability to the masses of elementary education (which in Mexico constitutes a six-year period), in the acquisition of basic skills and the capacity for abstraction; in the cultural model of learning to learn. The non-fulfillment of these goals, the exclusion of large groups, the marginalization of parts of the population, and the poor quality of the learning skills acquired in the system, are not the fault of the goals themselves, since major goals are by definition unrealizable or utopic. The model represents an ideal, a design for an educational structure that would generate principles to guide the action within the school, the relationships between the school and the community, between the school and the rest of the educational system. As an ideal model, its goals may be difficult or impossible to achieve, but not therefore to be ignored.

The problems lie, as we insist throughout this work, in the application of the model within the specific context of educative action, where in spite of the abundance of room for versatility, intuition and interest, little is done. Authorities, teachers, parents and students have demonstrated extreme indifference to seeking meaningful solutions to the problems pertaining to them. If the basic school continues to function as an agent of reproduction, propagating marginalization through the non-integration of important segments of the population, it is because the State has not been adequate to attend to the interests of the working and rural classes. Even if they appreciate the value of education, these classes, not clearly aware of their own interests or their ability to put pressures on the system, have deferred to the teachers (principal agents in the process) and to school authorities who may not always take interest or pleasure in their profession.

What is interesting is that the "rate of return" for primary education, on both the social and individual levels, is the highest of the rates for all levels(1). So even from the economic point ov view, the guarantee of access and completion of the basic levels makes sense.

At the middle and upper levels of education, relationships to industrialization, technical progress and development are less known, and evidence is fragmentary and contradictory. In terms of the formation of human resources, there are important irregularities in the whole conceptualization that are related to the formation of productive agents for the labour market. The most technocratic model (for example, that which is used in those countries with the most authoritarian power structures) demands the separation of the intellectual components of education -- those that generate creativity and critical conscience -- from the instrumental components -- specialists who adjust themselves to carrying out assigned tasks. If from the social point of view the school has already instilled in the students the inequalities that in terms of capacities, skills, knowledge, cultural patterns, values, etc., relfect stratification and class, the educational policy serves to reinforce the imbalance, limiting access to and utilization of the educational apparatus in line with the power assigned to each social group. The whole concept is what these educational levels serve for is complicated by simplistic hypotheses that, upon detecting a real problem, promote solutions that further complicate rather than resolve. This is particularly true of the relationship between education and employment and the attempts to affect productivity by means of early specialization, determined on the basis of assumed parallels between educational systems and jobs.

Detailed descriptions of the sets of capacities associated with specific occupations can be made within specific enterprises, because skills depend not on abstract definitions, but rather on the particular technological and organizational order in each individual enterprise. The usefulness of formal education in filling the demands of the industrial sector are then determined by the characteristics of the industrial apparatus themselves, and also of course by those of the environment. It should not come as a surprise to anyone that the graduates at any level of the system are not in a position to be incorporated immediately into practical activities; adjustments to concrete situations come to depend on existing specific conditions of production and on the systematic or non-systematic training systems that each enterprise designs. The strategy of the school producing a "finished product" is counterproductive therefore when instead of increasing flexibility, it generates rigidity at all levels of the system. One thing is clear: the more solid the basic formation of the individual, the greater his capacity to adjust to changing situations. However, arguments against specialization must be qualified, since there exist momentums in the formal educational process where specialization is not only possible but desirable.

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(1) See especially Psacharopoulos, G. 1981. Returns to Education: An Updated International Comparison: Comparative Education, Vol. 17, No. 3, in which the author, analysing 44 countries, arrives at interesting results whose implications for the design of policies contradict those of research and of common-sense appraisals.

The challenges facing academic and professional formation have to do, then, with capacities for adjusting to routine or changing needs imposed upon the skilled worker, the technician or the university graduate by the enterprise. In the educational system, one learns to learn, and when that is achieved, speed, quality, relevance of the adjustment to concrete experiences will increase with the degree of basic knowledge that in each level of the formal system, including the level of specific disciplines, defines learning and adaptation. The ideal of an educational system in terms of employment, it could be said, is the individual's formation for his final occupation rather than for his first.

III. Education and job training

We differentiate conceptually between education and job-training. The main function of the educational process is that of facilitating and favouring adjustment to changes that occur in the environments of people, in which people could become active agents. Training systems favour and facilitate adjustment to jobs and to particular tasks. For the educated man, training is not only easier but more relevant and dynamic.

The enterprises that make up the industrial sector differ from those that elaborate final products with imported technology or technological packages, through those that attempt adaptive innovation based on existing products and processes, to those whose activities are oriented to the search for original products and new forms of production. The specific capacities required for carrying out functions in one kind of enterprise or another vary: the more imitative the set of activities, the greater the routine, the greater the incidence of on-the-job training, the less formal education and general knowledge is used. Inversely, the greater the innovative component, the greater will be the weight given to formal education and knowledge of a general and specific nature. Planning the educational apparatus as a function of routine industries and activities implies reinforcing the organization of work and accepting the circuits that generate dependency. Within the companies, the engineers and professionals involved in manufacturing activities tend either to be grouped around direct production or to be assisting production. Rare are the research and development activities. In their excellent study, Vivas, Carciofi and Filgueira(1) point out two types of learning for groups of professionals involved in plant production tasks or manufacturing engineering: specific-technique and the scientific-technological.

The former is that which is acquired in professional practice within the enterprise, it concerns characteristics of design, operation and control of a production plant, the engineering of processes, or the production of consumer goods -- final, intermediate, or capital. It is the knowledge that is acquired not so much as the fruit of a systematic effort of learning, but as the result of participating in carraying out tasks. This type of on-the-job learning can naturally be completed by formal training in courses, which contributes to faster and more efficient adjustment.

Scientific-technological learning, on the other hand, is knowledge that an engineer or scientist acquires, creates, or contributes to, through participation in research and development activities within the enterprise, directly or indirectly connected with a process of production, whether or not it has an immediate applicability in the company. The nature of the learning is different, then, to the specific-technique, in that it depends more on scientific activities and experiments and less on direct, pragmatic production goals.

On technical and professional levels, whatever the learning tasks, capacities of adjustment would depend on the type of formation received in the universities and technical institutes. Curriculum structures on the professional levels general feature (a) a scientific component (the study of analytical tools that give the professional the capacity to understand theoretical and applied problems in his area of study); (b) a technical-professional component (the study of phenomena within the broad discipline); (c) a technical-specialized component (the study of phenomena within the specialization). These three components are exemplified by the training of, say, an engineer, a mechanical engineer, and a turbo-generator mechanical engineer. On the post-graduate level, an additional component could be added, which is synthesized in the capacities and methodologies necessary for the application of present knowledge to the creation of new knowledge, for the formulation and study of new problems.

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(1) Vivas, J.; Carciofi, R., Filgueira, C. 1980. Aprendizaje, inovacion tecnologica, y recursos humanos universitarios. Considiraciones sobre el caso argentino. Project for Development and Education in Latin America and the Caribbean Buenos Aires, Unesco, UNDP, CEPAL.

The interviews conducted by Vivas, et al show that "modernizations" in university disciplines generally arise autonomously from the productive sphere, and obey the internal dynamics of the educational system; they grow chaotically towards operational conceptions, so that university students learn only forms of operation without acquiring general knowledge and basic principles. The problems of basic formation were not present in Argentina at the time the study was made, but very probably exist in Mexico now.

But technological dependence and lack of the dynamism that would favour technical progress are not caused solely by shortage of qualified human resources, or from lack of the basic and applied knowledge necessary for developing "appropriate" technologies or any technologies at all. They also arise from the lack of the organizational abilities to make use of available knowledge and to make it effective in production. As the case of Argentina illustrates, there may be satisfactory, even abundant human resources available, but they may not be properly utilized because at the time that the industries begin technological activity, the government sets down policies favouring the free importation of technology and goods, and an environment detrimental to generating scientific wisdom and technical knowledge is created. The phenomenal "brain drain" experienced by Argentina was in part the result of such policies.

With respect to the possibilities of reform and change in the educational system, we operate on the basis of two broad assumptions:

Proposition I: Changes of a technical type (improvements in the educational system - internal and external efficiency - within the parameters that the overall society established) do not vary with changes in the relative force of distinct pressure groups within the society, but rather with the efforts exerted to make such changes possible: greater financial investment, improvement in teaching-learning conditions, higher quality of teachers, better teaching methods, more relevant curricula, in short, better quantities and qualities of material and non-material conditions within the school.

Proposition II: Educational revolutions, expressed as substantive and significant changes in the philosophy and conception of education and their application, result from revolutions or substantial changes in the society which radically affect the equilibrium of the social forces within the society and transform the economic, political and social systems that in synthesis define relationships between men. When these revolutions are translated into plans, the national destiny is altered.

IV. Structure of the study

This study is an attempt to analyze the contribution of the educational system and of job training programmes to industrialization and technical progress in a specific region, it is divided into three sections. The first section consisting of two chapters, treats the subject generally.

Chapter I, "theories of Development and the Role of Education in Progress," presents some perspectives in the role of education according to distinct conceptions of development, as well as some mechanisms of action favouring technical progress and innovation. A number of debates have taken place in Latin America since the nineteenth century, treating the principal perspectives, doctrines and practices of present public policies, especially in Mexico. The historical experience of Latin America shows that from the beginnings of the formation of the nation-states, education and training have had an important place in government programmes. This study questions some of the assumptions of "backwardness" in the area because of the lack of ideas and planning and, at the same time, shows that one of the fundamental problems in the evolution of the development thinking in Latin America has been the acceptance of patterns and of values, of conceptualizations of our problems derived from European and North American thinkers, remnants of patterns and values pertinent to metropolitan interests. Perhaps a little touch of originality has been introduced into the area in the past 30 years or so, during which, as a consequence of the development process itself and its failure to promote growth and equality and to strengthen the entrepreneurial classes, employment, etc., Latin American thinkers have been compelled to concentrate the process of development in the specific historical context of the area.

Structure of the study

Chapter II, "The Educational System in Mexico," describes the structural characteristics of the system and its evolution, as well as the place of technical education in the general programme of the government. We found it necessary to describe the formal educational and training systems at the national level, because most of the educational inputs to the conurbation in the next few years, will come from the rest of the country. This is already true of university and post-graduate education. From another perspective, knowledge of the characteristic operations and structures of the educational and training systems at the national level should be useful for detecting major problems, so that they can be taken into consideration in planning and implementing such services in the region.

The second section of the study deals specifically with the Conubal zone of the Lower Balsas River, and is composed of five chapters. Both from the technical and conceptual point of view the planning of educational and training systems, as well as the calculation of the requirements in human resources in the short and medium terms, require detailed data on certain specific dimensions. Accepting the thesis that the region must be defined as a whole, and not considered merely from the urban-industrial point of view, not only the industrial port and the developed subzones must be analysed, but the entire region, which is supported primarily by agriculture. The dimensions analyzed in this section are: industrial development, the agrarian structure, the structure and dynamics of the population, and the educational structure. We finish the section with a set of calculations of the human resources that will be needed according to the plans established for the industrial port in 1980.

Chapter III, "Industrial development," analyses the present characteristics of the production structure in the zone, as well as its assumed development strategy. The characteristics of the most important industrial plants are listed, including volume and type of investments, technology, and expected volumes and types of production.

Chapter IV, "Agrarian Structures," analyses the general characteristics of rural areas in two subregions, coastal and mountain, the uses of the soil, units and types of production, technology, organization of the work, use of credits, and trade. We end this chapter with descriptions of 13 areas, based on their normal system of interaction resulting from recent or historical processes that they have in common. This research does not include any empirical estimation of the human resources needed in the rural areas in the short and middle term. The description of the 13 subzones may be useful to planning agencies in defining the mechanisms of implementation of some much-needed basic services, based on units that go beyond political boundaries.

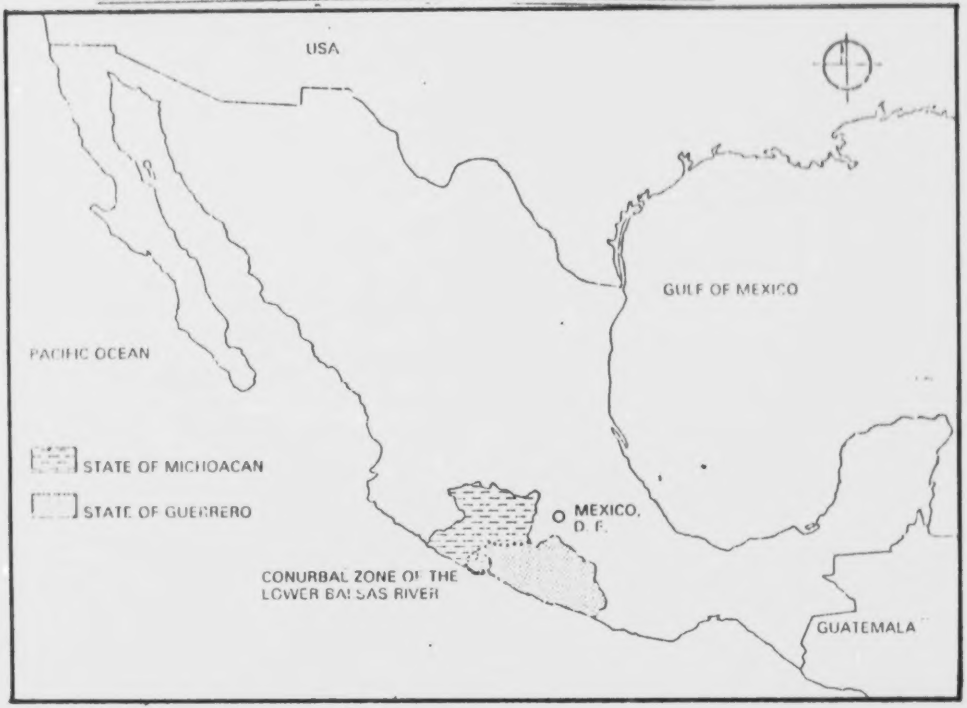
Chapter V, "Structure and Dynamics of the Population," describes the evolution of the populations of the five municipalities that constitute the Conubal zone, with special reference to the trends in urbanization, the composition of the economically active population and its composition by age and sex over the period 1930-1980. The latter part of the chapter examines population projections for 1985, 1990, 1995 and 2000, from three points of view: one historical or tendential; one programatic (i.e. taking into consideration the abatement of the high natural growth rate and the modification of current migration patterns); and one "industrial port hypothesis" in which the prospects for productive investment are considered, along with the dynamics of the attraction resulting from job availability.

Chapter VI, "Formal Education in the Conubal zone," analyses the situation previous to the expansion of the poles of development, and the dynamics introduced by the emergence of industry and tourism. The educational supply is examined by level of formal educational system, and some description of the internal efficiency of the system is included. The training programmes of major companies are detailed, including lists of courses offered in the micro- and macro-region.

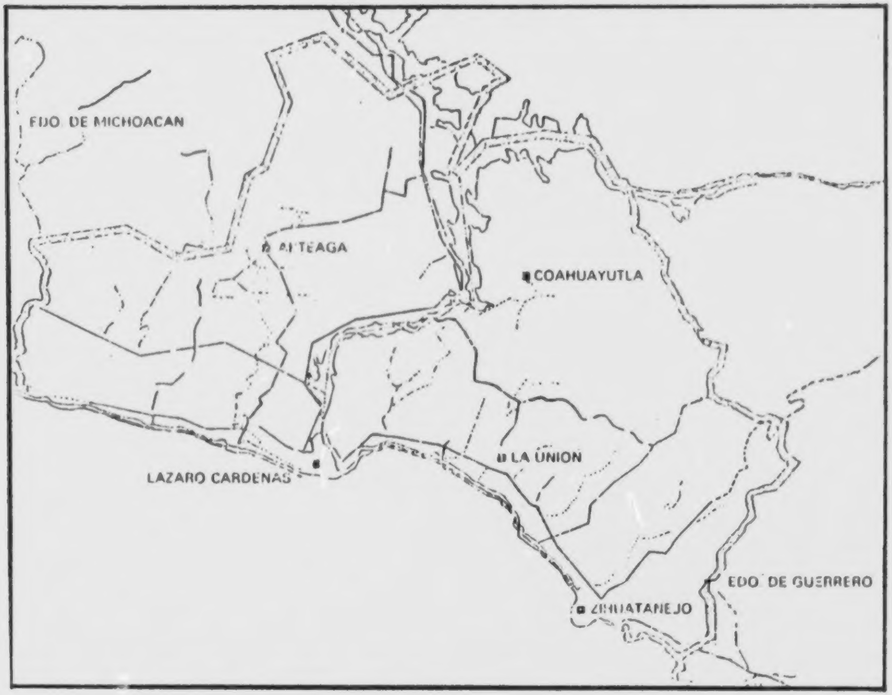
Chapter VII, "The Micro-region of Lazaro Cardenas: an Estimation of the Human Resource Demand," concludes the section, calculating the demand generated by industrial activities in the port, as well as some demands for the micro-region and the Conubal zone in the medical and teaching services at the elementary and secondary levels, and the estimated offer and demand for university graduates in the country as a whole for 118 professions in 30 sectors of the economy. Calculations of demand in the Lazaro Cardenas micro-region include, in relation to the establishment of industries, a conservative and an optimistic hypothesis, and also hypotheses of constant and variable productivity. The employment calculations are classified in four groups: professionals with university degrees, middle-level technicians, skilled labour, and unskilled labour.

The third section ties up the report with a chapter entitled "General Summary and Conclusions," in which we discuss the implications of analyses, theories and plans pertaining to the Zone, and propose some general suggestions for the design of an educational policy for the region, as well as some unanswered questions that must be answered in a deeper treatment of the subject.

Location of the conurbal zone of the lower Balsas River



Conurbal zone of the lower Balsas River



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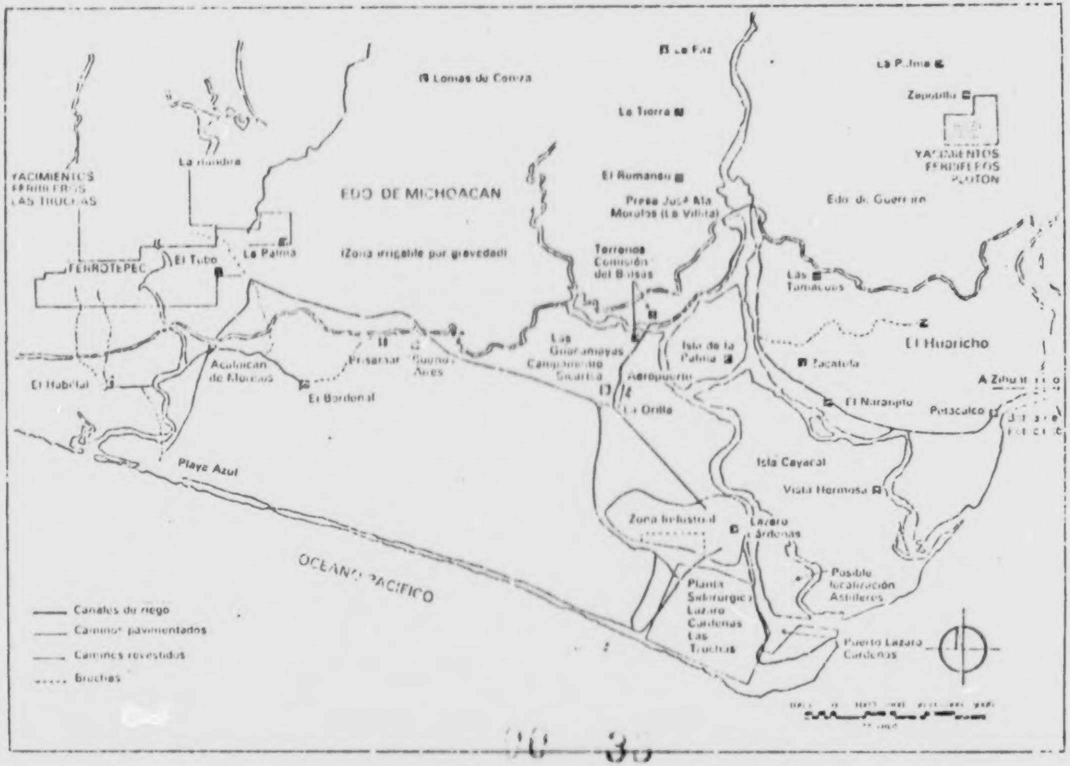
Microregion of Lazaro Cardenas



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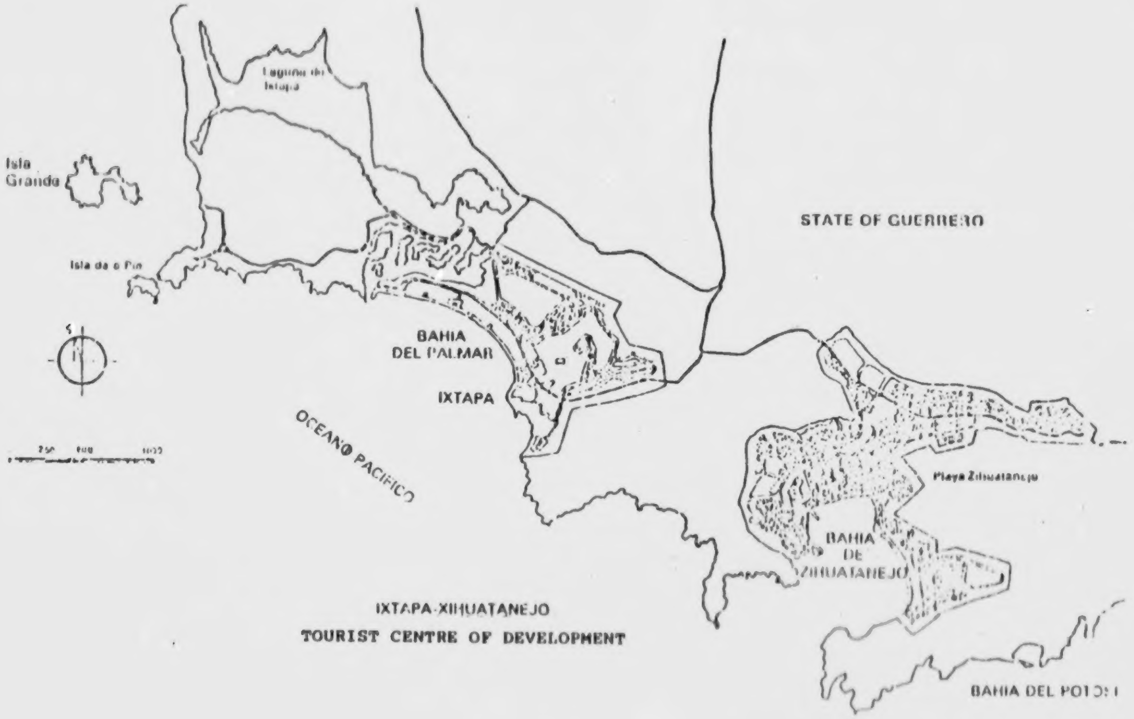

IXTAPA-XIHUATANEJO

TOURIST CENTRE OF DEVELOPMENT

Education, industrialization and technical progress in Mexico

Section I: DEVELOPMENT AND EDUCATION (General Aspects)

Introduction

The topic of the contributions of education to progress has been relevant in Mexico and in Latin America since the very origin of the Nation-States in the early 19th century. Interests in the formation of citizens for the new republics were joined, in varying degrees of lucidity, with proposals that tied the educative processes to emancipation and to industrial, commercial, and agricultural production. At the same time that arose dilemmas and contradictions that, with changes in tone and intensity, were to last right up to the present. We are referring to the dilemmas of specialization versus diversification of production, and the type of education that would correspond to one strategy or the other; to the role of education in politics (especially in problems of order and technical progress). G. Weinberg illustrates, with an example from Juan Bautista Alberdi, the changes in the models and bases for the organization of new countries. In 1837 Alberdi maintained that "education is not instruction ... to have a philosophy is to have a strong and free reason; to broaden the national reason is to create the national philosophy, and therefore, national emancipation." One of the principal elements in national emancipation, according to Weinberg, is mental emancipation. It is this same Alberdi that some years later would say, "The plan of instruction must multiply the schools of commerce and industry" and "Instruction in America should direct its goals towards industry"(1). But all this would later be abandoned when in *Escritos Economicos* he maintains that 'it is worth more to ensure and improve the production of those materials whose exportation forms the present commerce of the country, than to protect an industry of factory production that exists only in the sick imagination of some politicians with no common sense .... A manufacturing industry comparable to the vast European industry does not exist, nor will it exist for centuries. Later on he is even more radical with respect to the role of education: "To reduce the education of South American youth to intellectual production is like educating it in the manufacturing industry in general, a complete error in direction: South America neither needs nor is in a position to compete with, the European manufacturing industry ... a simple hide, a bale of wool, a barrel of tallow, will better serve South American civilization than the best of its poems, or its best novel, or its greatest scientific inventions ... With the value of a hide you can buy a sombrero or the entire works of Adam Smith, with that of a South American book you can't even buy lunch in Europe ... sciences are pure luxuries -- like the dead languages ... the populace needs to be educated in the practice of jobs and professions that most directly promote trade, the population, the productivity of the soil wealth, and the well-being which each and every one derives from the exercise of these fertile and noble occupations."

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(1) Weinberg, Gregorio 1981. Modelos Educativos en el Desarrollo Historico de America Latina: Buenos Aires, Unesco/CEPAL/UNDP. The Alberdi quotation is fromn Bases y puntos de partida para la Organizacion Politica de la Republica Argentina (1852); Fragmento Preliminr al Estudio del Derecho (1837) and Escritos Economicos (1895).

Almost one hundred years later, in 1949, Raul Prebisch from CEPAL(1), in questioning the fundamental suppositions of classical and neo-classical economics, returned to the topic of deterioration in the terms of exchange. "Reality", wrote Prebisch, "is destroying that ancient international arrangement of the division of work that, after having acquired great vigour in the 19th century, continued to prevail doctrinarily until well into the 20th. The role of Latin America, as part of the periphery of the world economic system, was limited to producing food and raw materials for the great industrial centres. There was no room for industrialization of the new countries. *The facts are imposing it*, however"(2).

There remains then the necessity of a policy of industrialization in the periphery, based on the capacity of accumulation of savings and increase in productivity. Education and technological innovation are necessary in the periphery because the fruits of technological progress, together with specific social conditions, have different consequences in the centre than in the periphery.

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(1) Economic Commission for Latin America.

(2) Prebisch, Raul 1982. " El desarrollo economico de la America Latina y Algunos de sus Principales Problemas" quoted in Gurrieri, A: *La obra de Prebisch en la CEPAL.* Mexico, Fondo de Cultura Economica.

Industrialization and politics, education and technical progress will appear and reappear in Latin American lives, impelled by a historical experience that remains alive. The advances in educational theory - especially between 1950 and 1980 - are important, incorporating the singularities of the Latin American development process, balances of power and conflicts between social groups and classes. Analysts have emphasized different questions, and no overall, unified vision of the issue exists; yet there does exist a broader and more precise understanding of the fundamental questions. The political question is always relevant, because projects with which new generations work still have the strong flavour of the events of the past century. Liberty and progress are still subordinated to order almost as in the Porfiriato in Mexico or the Republic in Brazil; in the South authoritarian schemes in politics and liberalism in economics continue to prevail. The problems of operation of the educational system, and the generalized gap between the scientific and technological advance as compared to that of the more advanced countries, represent objective difficulties in Latin America that inhibit the process of development. Without claiming to give a detailed analysis in these two chapters, some very general reflections on the advance in theory and conditions of the educational system in Mexico may be put forward. Both serve as reference to the case study of a regional plan for the conurbation of the Lower Balsas River, in which there are not only general problems of development, but also problems of availability of skilled manpower. It is a "new" zone, and in this sense the creation of institutions should be much less complicated than the transformation of those already existing in which problems of bureaucratization, resistance to change, generation of inequalities or reproduction of existing social and cultural conditions have been detected. The times are appropriate to avoid simplifications and learn from the mistakes of the past, which unfortunately seem to be repeated in the educational strategies in the zone.

I. THEORIES OF DEVELOPMENT AND THE ROLE OF EDUCATION IN PROGRESS

1. The nineteenth century: formation of the citizen

Preoccupation with development and technical progress is not a new phenomenon in Latin America. With different terminology, the reflections of the 18th Century, rooted in the Industrial Revolution in Europe, were rapidly incorporated in Latin-American thought by means of the Enlightenment in the periods immediately prior to the Wars of Independence, and through the theories of Encyclopaedism and Liberalism in the periods corresponding to the formation and consolidation of the National-States in the 19th century.

During the first half of the 19th century, Bolivar in Colombia, Varela in Uruguay, Juarez in Mexico, and Sarmiento in Argentina, to cite only a few, recuperated and consolidated the modernizing spirit of the Englightenment that proposed the secularization of societies, the diversification of production, the revitalization of culture through education -- an education aimed at diversifying the economy, creating a better administration, improving the way of life(1). And in all these societies, it would be the State that would be charged with promoting the processes.

The case of Argentina, with Sarmiento and the 'Generation of 1837,' embodies the generalized concept of the modern State in Latin America, and of the role that education plays in the formation of the citizen. A reader of Adam Smith, inspired by Tocqueville, Rousseau, Jefferson and Franklin, Sarmiento is perhaps best examples in his era of the will to integrate the educational systems into a general plan of modernization in America. Based on the civilization-barbarism dichotomy, the theme of Sarmiento is that of educating the citizen, preparing the ignorant masses, the "wild and barbaric gaucho' for political, technical and industrial evolution. The medieval colonial influence was to be eradicated at its roots. Ghioldi (1963) well synthesizes the thinking of Sarmiento when he affirms:

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(1) See for example: Weinberg G. 1981. Modelos educativos en el desarrollo historico de America Latina.

> "The tendencies revealed in the historic development of Argentinian education are fundamentally the secularization of its government, the modernization of its planning, the democratization of its organization and destiny, and the substitution of the scientific spirit -- based on historical philosophical concepts -- for universal theology. May (1) puts an end to our ancient and medieval world, and inaugurates modern times. It incorporates living languages, natural sciences, civil rights, national and human history, secularized philosophy. The Celestial Encyclopaedia of the colonial era, with its static beings and ideas, gives way to the secular sciences. From the supernatural that was taught to few, we pass to the teaching of natural and human sciences to many - basically to the majority of the population. This is the direction of Argentina educational institutions, and Sarmiento is the interpreter and motivator of the great changes imposed by history on public education.
>
> " ... All the elements and factors of modern educational policy are expressly stated in Sarmiento; amongst them the following are essential: the full comprehension of the meaning and movement of modern societies that link in one unique operation their transformation through educational structure and technique; the political and historical philosophy that characterizes the ideals of a people, and which should be converted into tradition by the school; the modern definition of the State as social and secure, and therefore educating and teaching; the technical-pedagogical organization with an indication of the content of the study plans and precise didactic norms; the administrative organization governed by criteria of efficiency and economy, by principles of control and responsibility, with the intervention of authorities and parents; the formation of teachers in special establishments called normal schools; the bases of

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(1) The author is referring to May 25, 1810, the date on which national independence was declared.

legislation, finance and statistics -- indispensable elements for the construction of the educational system."

This quotation illustrates the fact that if the educational systems in Latin America are "behind the times," it is not from lack of new ideas concerning the functioning or organization of a system; it is not due to an incapacity on the part of its leaders to perceive and visualize the role of the educational process in national construction and in the processes of industrialization. The historical experience of Latin America seems to indicate that the basic problem is neither one of scarcity of programmes amongst politicians, decision-makers and intellectuals nor of intellectual climate; the climate of opinion, on the contrary, is favourable and functional to the secularization and modernization of the societies.

"Modern" educational systems and changes in structures are not brought about solely through the impetus of ideas of the time. The history of the early introduction of the ideas we accept as modern clearly shows us that, popular as they were, they were far from being implemented. It would seem that in the dynamics of implementation, complex factors intervene, and it is the interplay of politics and economics that determine the dominant directions that implementation will take.

In the 19th century, the fundamental preoccupation of Latin Americans was to set up and consolidate the Nation-States. The goal of modernization was the formation of citizens who would participate in a responsible way in the national life. The political ideal was the educated man, who could transform institutions and contribute to the advancement of society on all levels. Work, and the creation of resources, which are the cornerstone of 20th century philosophy, were not yet emphasized in the 19th as the obligation of the responsible citizen.

In the economic field, the Weltanschauung, the conception of the role of education in progress, was based on 'optimal' and 'immutable' principles of a natural individualist order: economic units that behave according to unchanging principles of free competition in the market, freedom of contract, etc. The belief in freedom and progress was based above all on the optimistic view that grants to reason the status of principal order of the universe; it is through reason that institutions are created and encouraged under the assumption that we are capable of ordering the relationships not only between things (by means of secularized science and technology) but also between men (through education and democracy).

In such countries as Mexico and Brazil, secularistic liberalism was rapidly transformed into 'positivism'. For example, the concept of the French encyclopaedists were incorporated into the Porfiriato projects, and those of the 'wise men' into the régime that resulted in the Revolution of 1910 (with a prolonged anti-scientific period in the post-revolutionary political régimes).

These are, in a very condensed form, the dominant progressive ideas of the 19th century; this is not the place to describe in detail the innumerable debates that are still carried on between 'liberals' and 'conservatives', the role of the church in the secularizing processes and the strategies of industrialization and/or specialization in farming and/or mining activities. Weingerg's publication (1981) is strongly recommended for its detailed analysis of educational models in Latin America throughout the 19th century.

2. The twentieth century: the economic problem

The educational and economic theories of the twentieth century regarding development will continue for a long time to take a secularistic and above all optimistic view of the role of reason, and to emphasize the contribution of educational systems to industrialization and economic growth. The first half of the century was dominated by serious world economic crises that troubled the optimistic visions of the expansion of capitalism, and by two World Wars that did affect Latin America, if not to the degree that they did Europe and North America; it was only towards the end of World War II that belief in a traditional-to-modern transition inspired new optimism. In the industrialized countries, macro-economic theory was reformulated to point up the importance of economic planning and policies that assure, for example, full employment. Preoccupation with industrialization, protectionism, and technical progress are familiar in countries such as Japan and the USSR, but except during short periods such as that of "socialist education" in Mexico in the thirties, their impact was not felt in Latin America. The themes that dominated education were pedagogical.

At the end of World War II, emphasis passed from the political to the economic. The central concern in the industrial countries, especially the U.S.A., was now with the forces that stimulate development, especially in underdeveloped countries. The themes of the transition of societies from "traditional" to "modern" and of industrialization by stages were dominant. The ways in which resources are utilized and the principles that regulate social relations were studied, and the rôles played by education and by science and technology were stressed. The analysis of the conditions by which it is possible to implement educational systems aimed at preparing individuals and societies for modernization led to a set of diagnoses and recommendations promoted by the new international agencies that, if applied in the less advanced countries, would supposedly result in increased rationality in production and innovative capacity of individuals and institutions in the short run, and in the long run in a kind of society and a development similar, if not identical, to those achieved by the now more advanced societies.

The theme of economic advance in the developing countries, and of the transition from traditional to modern society, continued, however, to be charged with ideology, appearing in Latin America in the fifties on the wings of the Cold War. W.W. Rostow's book, one of the more widely circulated of that time, promotes the theme of industrialization in stages, with the suggestive title: "The Stages of Economic Growth. A Non-Communist Manifesto".

Although the policies of development were taken by the new leading classes, whose social origins reflected the structural transformations that had been taking place in Latin America in the fifties, from CEPAL, Latin Americans and international experts questioned the neo-classicist theory of International Trade, an outgrowth of the ideology of transition in stages. From the CEPALian arguments would later emerge what is known as the "theory of dependence."

(a) The contribution of CEPAL

CEPAL's opposition to the neo-classical theory clearly showed its scepticism of the assumption that international trade would in the long run evolve egalitarian structures between nations through the simple mechanism of equalization of remuneration in the factors of production. Pointing to the deterioration in the terms of exchange, they stressed the structural and institutional factors that operated above and beyond the free fluctuation of market prices, making the historic structural differences between developed and underdeveloped countries the determinants of dominance and dependency. According to Cardoso, the practical policy recommendations of the CEPAL analyses of the fifties were the following:

- to strengthen and modernize the State through the creation of "Public Development Agencies";
- to ensure industrialization by incorporating technical progress, at first by attracting foreign capital investment, and later by generating local investment;

- to shift the principal axis of the economic system from the exterior to the interior by expanding internal markets. Agrarian reform would be prerequisite, and the rural economy would have to be technicized to aid industrial production and the Food for the Cities programme;
- to increase the prices of export products to cover the costs of labour, and to raise the remuneration of labour to acceptable levels.

These recommendations reflect the structural transformations which weakened the oligarchic sectors in whose interests the traditional exports of the primary sector had been organized, promoting a new middle class and new groups of middle and small industrialists whose lifestyles benefited by the new progress in scientific organization. The role of the State is again fundamental in the process, because through it are implemented the infrastructure projects and institutional reforms that favour urbanization, social mobility, diversification of social and political structures, in short, the social relationships of production capable of making our societies - with time and rationality - more like the North American and the European ones.

Almost the same criticisms - some justified, others not - that were levelled against the theory of transition and development by stages (i.e., that the models were abstract and that all the ideology was based on the structural and infrastructural conditions of developed countries, etc.) were applied as well to the theories of CEPAL; they were attacked from the right because they "favoured communism" and from the left because they were 'reactionary', or at least 'developmentalist'.

What is certain is that from the point of view of the education systems, this was the era in which 'educational planning' dominated the scene. The Ministries of Public Education began a task of organization of information, and the first programmes were articulated, stimulated by the demands of the international financial entities and other organizations offering technical co-operation that the educational programmes should have their place in integrated planning. 'Economicism' in education arose, and the educational systems became social organizations of massive size; the emphasis of the first studies was on quantitative problems, and planning assumed a 'neutral' type of education. The novelty of the new orientation was that it forced attention on the system not as a simple pedagogical instrument, but as the link between the social and technical division of labour. The models, still dominated by theories of 'human capital', form part of a unilateral ideology in which the quantitative calculations obscure the educational processes which we will later analyse.

(b) Dependence

From criticism of CEPAL's work and from CEPAL itself, the 'theories of dependency' were born. Emphasis was now on the structural, historical character of the condition of underdevelopment, relating its emergence - and its reproduction - to the dynamics of the development of capitalism on a world scale. The notion of 'domination' is introduced, not only between nations but between social classes. Patterns of class exploitation are analysed in the context of power structures: the relationships of local economies with developed ones or local entrepreneurs with the transnational companies links the former function as 'enclaves'. The analysis is politicized, not as CEPAL's first analyses of 'wills' and 'objectives' were politicized, but rather as a discussion of social relations of production that include exploitation and domination inevitably must be. The elements of the theory synthesized by Cardoso are the following:

- we are dealing with situations in which there is financial and technological penetration by the developed capitalist centres;
- this produces an unbalanced economic structure both internally in the peripheral societies and between them and the centre:
- this unbalanced economic structure imposes limitations on self-sustained economic growth in the periphery;
- and favours the rise of specific patterns of capitalistic class relationships:
- thus modifications in the role of the State are required to ensure both the functioning of the economy and political expression in a society in which there is a centre of inarticulateness and structural imbalance.

Let us reiterate that dependency is not only economic; it is specific to the social relations of production that include exploitation and domination. Growth in the periphery is not limited solely by a lack of technological progress or the amount of foreign debt; these are indicators. Dependency exists as an expression of an international movement of capital that Cardoso (1979) characterizes in the following terms:

> "...while it expands to a world level *formally and structurally*, the reproduction of capital *implies its circulation*; and capital circulates on terms which are *asymmetrical* and *discriminatory*. Appreciation and the

appropriation of appreciated goods by the central bourgeoisies are also discriminatory phenomena in the conduct of international exchange, and constitute visible aspects of the condition of dependency. Essentially, depending means the extraction of value increases by means of the process of production, and where there is a relationship of dependency, this extraction implies a position of control -- or 'penetration' -- of local labour by foreign capitalists. This is an incidental characteristic, actually, since it is also possible for local capitalists to extract value increases. Most of the resources gathered in the periphery are transferred to the centre, thanks to the heterogeneity of the productive system of the world and the inequality in the relative strengths of their technological sectors. Thus the deliberations and decisions of the peripheral nations experience real difficulty of application on the levels of world trade and the international system of production. Obviously any analysis of these processes must take into consideration the dynamics of class relations along with those between Nation-States; it is through them that the concrete forms of local domination are expressed, just as relations between bourgeoisies express international dominations."

Corresponding to these economic dilemmas are a number of social effects:

"- bourgeoisies that complement each other only by associating their production with that of foreign capital and/or subordinating themselves in international trade;
- elements of the proletariats that disengage themselves from the rest of the masses through progress in industrialization or by exporting through agricultural and mining enclaves;
- 'marginal masses' not easy to observe, even when industrialization prospers;
- a false 'petty bourgeoisie', not exactly corresponding to the concept of petty bourgeousie of European competitive capitalism, but rather to broad layers of salaried workers (white-collar workers, technicians and professionals) generated by the internationalized and oligopolitical form of the transnational enterprise that crushes the earlier service and trade structures.
- a social structure in the rural areas that allows a broad spectrum of social relations of production, while subordinating the various classes and strata to large capital (from the peasants that work the land with family labour through the gamut of relations involving

middlemen, land leasing, semi-coercion of workers, etc.)". Finally, on the political level, Cardoso points out:

> "... a repressive Producer State emerges, which while presenting itself as national, organizes capitalist exploitation. In doing this, it sometimes comes into conflict with the immediate interests of the local bourgeoisie and the transnationals, and becomes a Capitalist-Producer-State; but at the same time it becomes an essential element in viabilizing private accumulation and entrenching the mechanisms of distribution of income and government spending, of the circulation of goods, and the accumulation of capital on which the dependent-associate relationship develops. The State thus becomes the driving force of discriminatory development, the concentrator of income, based on a system of production at the service of the upper-income strate."

The theories of modernization are also refuted by several versions of the Gunther Frank "dependentism" practiced by internal and international colonialism. In questioning the "acquired truths," Stavenhagen (see Zapata, 1981) develops his work on the Seven Erroneous Theses Concerning Latin America; and it was these theses that guided development policy decisions.

1. - that the Latin American countries were dual societies (the concept is inadequate since the notion of internal colonialism better reflects the subordination of certain regions to urban and industrial centres);
2. - that progress would be achieved through the diffusion of industrial products in the more backward regions (what really happens is that the means of survival of the native population is destroyed and nothing offered to replace it);
3. - that archaic and backward rural zones constitute an obstacle to the formation of an internal market and to the development of national and progressive capitalism (modernization and industrial and urban progress take place at the expense of these rural zones);
4. - that it is in the interest of the national bourgeoisie to break up the power and dominion of the landowning oligarchy (there is no evidence to support this claim, and the badly-named 'agrarian reforms' are an example of the alliance which makes internal colonialism possible);
5. - tnat development in Latin America is due to the work of a nationalistic, progressive, entrepreneurial and dynamic middle class, and the object of the social and economic policies of our governments should be to stimulate the social mobility and development of this class (the interests of the middle classes are found to

be linked to those of the industrial bourgeoisie and to those of the landowning oligarchy, forming part of the structure of domination);

6. - that there is national integration in Latin America thanks to intermarriage (there is no national integration: ethnic pluralism is necessary);

7. - that progress in Latin America will take place only through an alliance between the workers and the peasants, an alliance that presupposes parallel interests of the two classes (historical examples of this alliance do not exist; the peasants must conduct their own struggle).

3. Education and development

Development projects on the level of international agencies such as CEPAL, the World Bank, the IMF, etc., and of dependency theorists, will continue to diverge as to the most important aspects of the problem. Sunkel and Paz (1970) point out that their diagnoses of the basic causes thatr generate the processes differ, and to a large extent these determine the course of action. For example, the designation "poor countries" implies accentuation on the distribution of income and suggests as a solution the national and international redistribution of wealth; the designations "developing" and "non-industrialized" refer both to the possibilities of taking advantage of potential and to the role that industrialization has in the processes of change; that of "underdevelopment" refers to the structural and institutional situation as stages in the historical process of development, and suggests as a course of action changes in the structures that generate this type of situation. The notions of 'dependency' and 'third world' point to the characteristics acquired by economics, social, and political systems, for which the best course of action is to strengthen the national systems, break up imperialist relationships by uniting the non-aligned countries, encouraging South-South dialogue, etc.

The theses of modernization and of transition by stages (which were dominant in academic and planning agencies in the 50s and 60s) were paralleled in the educational sphere by two schools of thought, which justified and sustained them on the level of action plans. The first was functional-structuralism, the second, the theories of human capital.

In the fifties, these theories offered a framework that corresponded closely with both the environment of the cold war and the type of policies that international and government agencies sought to promote, and provided a wide set of technical recommendations that gave education a very active role through its potential for social equality and its contribution to technological change and the efficient use of human resources. Faced with the new strategies of important increases in public and private funding of education, both theories were attractive because of hypotheses of concensus and the promise they hold for rationality on the expenditure.

Education was justified on the social level as an equalizing agent, and destined to correct irregularities in the status of its members, guaranteeing that they would be rewarded not in function with their acquired status but for their real achievements. Guided by a democratic system and by the principles of meritocracy, one could (a) break with the structure of privilege that was not based on individual merit; (b) make certain that it was in fact the most capable who would have access to the most important social roles; and (c) increase the pool of human resources.

On the economic level, education was even more precisely justified as an investment in skills and capacities, and as one of the prerequisites for achieving progress and development. Emphasizing the pragmatic and utilitarian, closely concentrated on the problems of technological change and its impact on the occupational structure, a rational education system provided the individual entering the labour market with qualifications and dispositions in line with the anticipated needs of that market. The educated man not only does things better, but is more receptive to innovation.

Given this background, the general opinion of laymen, experts, and government agencies was that universal access to instruction should be guaranteed; success or failure once inside the system was an individual question, since there must be personal responsibility, and the individual must be considered an active agent within the system. On the economic level, human resource planning basically analyzed the inputs in human capital that the market required to guarantee modernization, industrialization, and technological progress. The newly formed planning agencies began to incorporate not only the theses that relate improvements in the quality of the labour force to production, productivity, and development, but others derived from Soviet models of systematic national planning. To achieve development, it is necessary to plan resources according to the needs of the economy, that is, with goals, principles and objectives that will correspond to the course of economic events in the short and medium term. For example, in the universities, it is necessary to rationalize distribution through methods and techniques that will divert enrolment toward the 'modern' courses required by industry (in engineering, geology and physics, for example) rather than the traditional courses in law, letters and medicine - in short, to anticipate the needs of the market and generate a quantity of graduates that will not exceed the demand, and thus to avoid problems of unemployment and underemployment, etc. But in the human capital thesis there is always an ideological undercurrent. Schultz (1972) makes this clear when he states:

> "The workers have been transformed into capitalists, not by dispersion of ownership through shares in public companies, as tradition would have liked, but by the acquisition of knowledge and skills that have economic value."

This is a clear and direct reference to a pro-capitalist model that will provoke extensive reaction in the periphecal countries. It should not be forgotten that the developments of the theories of human capital agreed with very clear symptoms of the reality, and above all provided a framework that came to correspond to the expectations of transformation and change. Even their ideological tone served the interests of the groups in power.

But the reality in fact proved that the problem of growth was not only a problem of the internal structure of economies and of the rationality of their procedures. The development of research, even within the framework of functionalist theory, finally revealed the inoperability of the model.

Four myths were found to exist in the concepts of the 'democratic' school, generator of equality and corrector of inequalities; in the idea that development is possible when the prerequisites of development that can be supplemented by the school system are implemented; in the affirmation that the process of development was, although slowly, being implemented in Latin America; and that it could in fact solve the particular problems in the area.

1. - *The myth of equality of opportunity* and of democratic and open systems, was illustrated by the fact that the problem is not only one of access to, but also of continuation in the system -- a continuation not determined by the merits of the individual but by the systems of stratification and social class that delimit the physical, psychological and cultural growth of children and at the same time determine the type of education they receive.

2. - *The myth of liberty* and the idea that men have inalienable rights that are implemented when they know how to read and write and can therefore understand these rights. Alienation is not the exclusive property of illiterates, nor do the conditions and practice of liberty and democracy exercised within the school correspond necessarily with those occurring outside it.

3. - The myth of social progress and the illusion that it is achieved by reproducing the processes that have occurred in the developed countries. As stated above, progress is not a category that is abstract or absolute, but rather a relational property derived from the structures that relate development and underdevelopment.

4- The myth of technological progress, and its capacity to resolve all other problems. Progress does not evolve from purely technical factors, nor from purely economic, purely cultural, or purely political factors. It derives from structures that affect the whole organization of the economy, the society, and the culture.

Denunciations of the inoperability of the school system varied in intensity from the radical extremes that supported the deschooling of society to those proposing to respect specific regional and national characteristics in programming and implementing plans and projects of educational reform. Despite the criticism, government planning agencies continued (and continue) to work with models that are similar, if not identical, to those that were so severely attacked by people in the social sciences.

These criticisms were correct in pointing out, among other things, that

- the model used was abstract, not taking into consideration the specific structural-historical contexts of Latin American societies and economies;
- its perspective was onesided, occupying itself principally with purely economic variables and relations, and treating the political, cultural, social and psychological relations as residual categories.
- The concept of 'human resources' mixed abstract problems of economic growth with more general aspects of development; the 'detected symptoms' were purely economic rather than general problems of development;
- being abstract, the model assumed that there was only one type of development (that which had occurred in the developed countries) and that what had occurred in those developed societies would occur in the underdeveloped countries, as soon as they programmed or planned their economic, political, social and educational structures correctly along a path essentially pointed out by the historial experiences of the now-developed countries;
- development and planning are done for "society" as if there did not exist within it social groups and classes, and distinct styles and models of general and educational development;
- in education and culture the model placed the responsibility for continuation and reinforcement on

traditional values, and blamed them for impeding the emergence of the values of science and technology, demanding therefore the modernization of the educational systems according to the criteria of maximum specialization, technological preference, and emphasis on pragmatism.

The most severe criticisms coming both from Latin America and from the developed countries themselves were related to corollaries derived from some of the more general assumptions of the theories. Amongst these,

- the most virulent had to do with fallacies in the theory itself, particularly those that emphasize individual situations, paying little or no attention to the structural relationships within the economy or the social consequences of the model. It was demonstrated that there was not only a problem of individual skills being incorporated into the labour market, but problems of productivity, of distribution of income, of the effective use of knowledge and skills, etc., more complex and concrete, and operating on levels other than purely individual ones;
- the theory assumes a causal and reciprocal relationship between education and development, when we actually do not know whether it is educational growth that promotes development or the reverse. Experience is proving that the inverse hypothesis is more plausible, but at the same time the rates of return of investment in education seem to be significant.
- more paradoxical were the hypotheses related to the democratization of society. In Latin America it was in countries with the highest educational levels (Argentina, Chile, Uruguay) that the strongest political authoritarianism occurred.
- the extraordinary 'brain drain' (see Padua, 1976) experienced by the countries of Asia, Africa and Latin America stimulated a rethinking of the possibilities of maintaining balances between supply and demand, between the formation of highly skilled persons and their absorption into the labour market. Where brain drain occurred investments in education were transformed into losses for the countries and another form of transference of capital. Problems of credentials unemployment and underemployment complicate the hypothesis even more.
- the demand for highly-skilled personnel would grow at constant rates. The present Mexican crisis is a classic refutation of this statement.
- it is the demands of the occupational system that determine the educational profiles of jobs. Clearly the

characteristics of the market modulate the relationship and although it is possible there actually are relationships, they are certainly more complex. In situations like those of the conurbation that we analyse in this study, it would seem at present that the reverse predominates - that is, that it is the profile of the supply that determines the demand.

- the principal obstacles to industrialization are found in the educational structure of the population. This affirmation is too general; it does not qualify the type of industrialization. But even general industrialization in Mexico and the profiles of its labour force (see Padua (1983) strongly challenge the hypothesis).

It has been pointed out that from many angles the theory of Human Capital did not operate as predicted by a model that proposed formal education as the detonator of a chain reaction that would favour everything from the democratization of societies and increased production to social organization and rationality -- in short the anxiously-awaited development. Although many of the elements mentioned in the theory -- the need for investment in education, for planning, for anticipating and rationalizing expenditures, etc. -- are essential to development, industrialization and progress, these conditions and circumstances go above and beyond the planning of education as such, and relate to specific characteristics of contemporary capitalism and its dynamics between the centre and the periphery.

4. Diagnosis and alternatives

Between 1950 and 1970, the capitalist economies of the central countries experienced the peak of their growth. In the peripheral countriesm however, the situation deteriorated as income concentrated in the central countries. The intensification of inter and transnational economic activities that escape the controls of national decision-makers were to generate waves of instability that culminated in the financial crises of the 80s and, as Furtado states, endangered the very existence of capitalism.

But Latin American criticism, very fertile on the levels of the sociology of development and the deformations of the model proposed by the theories of human capital were less effective in educational research. The deformations of the system having being proven, the alternatives offered had neither the capacity, the content, nor the depth of analysis to refute the theses of modernization.

The most radical options, that proposed the deschooling of society, not only smacked of pure voluntarism, inapplicable to viable political alternatives, but were and are found to be in complete contrast to the aspirations and expectations of all the sectors of the population. Utopias more European than Latin American were not viewed with enthusiasm, even by the more intellectualized groups. To a large extent, they suffered about the same neglect as the 'zero-growth' ethos. However, they forced attention toward a series of problems not then sufficiently mature that refer principally to the type of society that would have to be constructed, to an orientation in which equality would not be sought in abundance but rather in the rational use of scarce resources, to concept s of self-reliance, etc.

Non-voluntarist radical criticism, whose origins are found in Marxism, denounced the capitalist system and the school as a mechanism used by the bourgeoisie to reproduce itself. The alternatives it proposed -- the socialist model of the school and socialism as the means of overcoming dependency -- did not manage to convince the historical agents in charge of the revolutionary process. Neither the proletariat nor the peasants and marginalized groups understood what was being offered to them (this was not simply a problem of alienation or 'false conscience'), or when they did take on the project, as in the case of the important experiments of Paulo Freire in Brazil and Chile, they did so in the contradictory context of dependent capitalist countries, in which the vested-interest groups speedily caused the disappearance of such dangerous experiments.

What is certain is that there began to be wide disagreement in the specialized educational literature, which extended to practices that were defined principally in two ways; one was undertaken by government and power agencies, the other by academic organizations. A technocratic-instrumental style, that emphasized the technical division of labour by means of theoretical schemes that provided the rationale for the promotion of human resource training as a product of the objective requirements of the system of production, was favoured by economists; but as we have seen, it was severely criticized because of its concern with economics, virtually to the exclusion of the other social sciences. The other, critical-normative style, supported by sociologists, anthropologists and political scientists, is rather concerned with the social division of labour. Their analyses emphasize the differential distribution of privilege, the phenomenon of status, and the ideological and reproductive functions of the scholastic apparatus.

Of course every educational system forms resources and has ideological functions. The problem is the style of education that is adopted and the perspective of what the system is for.

Economistic or 'technocratic' styles see education as an agency for forming resources and productive agents to be incorporated in the labour market. Its most salient ideological aspect is its requirement that education separate intellectual components (the development of creativity and critical judgement) from instrumental components (the training of specialists to fulfil tasks assigned to them by others). At the outset it is agreed that equality for all does not exist; instead, the social demand for education should be channelled, both as regards access to and type of education, to the educational apparatus and flow system of mobility in relation to the possibilities of power assigned to each social group.

The 'sociologist' style (which is not really a style, as it lacks a uniform perspective and, more importantly, does not adapt itself to concrete terms because it is the simple result of criticism of the system) maintains that in our types of societies (capitalistic, precapitalistic or dependent capitalistic) the primordial function of the school is ideological, and its operation is mainly that if reproducing the actual social order through the socialization of each social group -- its styles, values, tastes, manners and knowledge. The proposals derived from these schemes present alternatives that are either outside our political possibilities (such as deschooling or socialist schools), dismissing every attempt at reform or improvement as bourgeois, or are impossible to achieve until the entire society is reformed according to the political model perceived as desirable by the analyst in question.

Each style, operating on a polarized ideological base, perceived itself as incompatible with the other, and will operate for fairly long periods independently -- the technocratic-instrumental style in the planning agencies, and the critical-normative style in academia.

During the seventies there began to be felt in this context the echoes of the counterculture movement of 1968 in the central countries, and criticism (from inside) of the bureaucratization of socialism. From this emerged, amongst other things, a lack of confidence not only in the reform capacity of the institutions, but in the validity of wisdom and knowledge. In academic circles there was a loss of "sense of purpose" and a catastrophic and somewhat cynical attitude toward the possibilities of solving the problems and meeting the challenges of the new situation. Although the implicitly reactionary preference of non-development over development

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expressed by some European and Asian theorists(1) were rejected almost completely, some positive elements were assimilated. Amongst them Cardoso (1970) emphasizes the following:

- the real concern for the destruction of non-renewable natural resources and the deterioration of the environment;
- the idea that equality should be sought not in the squandering of abundance but in the rational use of resources;
- the reaffirmation of the belief that the lack of resources on a world level is due not so much to scarcity as to poor distribution;
- the assertion that the style of development experienced by the advanced countries cannot resolve the questions of under-development and dependency;
- the obvious effects of misdevelopment, that are found so often in the social systems of production -- be they capitalist or socialist -- are related to the civilizing pattern, of a technological-industrial base;
- the belief that it is on the political level that schemes favourable to the concentration of wealth are broken and that the 'vicious circles of poverty' can begin to be ruptured, through the restructuring of relations of exchange between the nations in a new international economic order;
- particularly suggestive for this project is the idea that to achieve these objectives it would be necessary to ensure the availability of local knowledge, creativity, and innovation, especially in the area of technology;
- the social notion that the objectives of development are not capital accumulation, but rather the satisfaction of the basic necessities of man (first of all those of the dominated and exploited);
- the indication (from the elaborations of I. Sachs that reject the 'utopia of community development' and maintain the need for deep transformation of technologies and productive systems) that in the present world there will not be reasonable development without self-reliance, without appropriate technology, without the compatibilization of formal rationality with technical rationality, fitting social and human objectives to available means and to technical calculations.

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1. See especially WOLFE, 1978: Chagula et al, 1977; Commission des Organisations Suisse, 1975; The Dag Hammarskjold Foundation, 1979.

- the concept of self-reliance not as autarchy or self-sufficiency, but as 'autonomous definition of lifestyle and development', stimulating creativity and better utilization of the factors of production, reducing vulnerability and dependency.
- this in turn leads us to a restatement of the concept of technology, a restatement that does not confuse 'appropriate' technology with 'retarded' technology but rather takes into consideration the basic objectives of development; that does not scorn science or the advances of the productive forces; one that accepts transference but is selective and leads to the autonomous creation of technology.

Thus we arrive at the principal problem of this study, since the last element leads us to the problem of the formation of specialized human resources, of educational policies; of resolving the contradictions between the role of the State and role of the educational systems, between technical knowledge and the criticism of the system, etc.

A very important number of these considerations, plus some derived from dependentist theories and from the sociology of education in the central countries, have been incorporated into contemporary analyses of the role of education in development, industrialization, and technical progress. The work of the Project for Development and Education in Latin America and the Caribbean, coordinated by German Rama under the sponsorship of Unesco, CEPAL and the UNDP, is important to a general analysis of the area and to those of particular countries. In the analysis of the production of technology, the works of J. Katz and the Fundacion Bariloche in Argentina those of Jorge Sabato and Michael Mackenzie, as well as those of CONACYT and those that emerged from CEPAL's organized symposiums are added to those of numerous groups that work out of government and international organisms in most of the countries in the area(1).

In the decade of the sixties, the first studies were carried out on education, human resources, and socio-economic development of a technical character, in an environment that had been mainly dominated by general statements of principle. Typical of these are the studies undertaken by the Argentine Secretaria del Consejo Nacional de Desarollo (1968) that served as the basis for educational planning in Argentina. Although these studies were almost exclusively limited to problems of quantitative evaluation of internal efficiency at all levels of the formal and informal systems, carrying out estimations of human resources for the short and medium term, they collaborated with other studies of a more qualitative character undertaken by the same organization, and incorporated earlier studies by other organisms, as for example, the Centre for Vocational and Professional Orientation of the University of Buenos Aires.

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(1) See Katz J. (1976), Sabato and Mackenzie (1982), CONACYT (1981), and CEPAL (1974).

Closely parallel to the elaborations of the 'theories of dependency' are the studies done within CEPAL by Marshall Wolfe (1967), Jorge Graciarena (1967), and Medina Echavarria (1964). Aldo Solari (1971), and German Rama (1974). All of these works stress the interpretation of development as a process of social change, differentiation in the patterns of evolution of the school enrolment in developed countries and in Latin America, and specific educational styles on regional and national levels.

The works of Solari and Rama are more specific to education. Solari does comparative analyses of structures in the developed countries and in Latin America (pointing out differences in terms of patterns of evolution, and hypotheses which consider economic effects and those of stratification), and studies the effects of pressure groups on the development of education and its links with the labour market. Other works of Solari are related to educational policies in Latin America and as the potential impact of education on justice and social equality.

The works of German Rama are even more suggestive, analysing the relationship between processes of structural change and education (proposing a typology in which styles of development, functions relevant to education, and its political, economic and social dimensions are treated, all in the light of the relationship between social classes and the transformations experienced in the processes of economic and social development). Studies conducted under his leadership have been published by the Project on Education and Development in Latin America and the Caribbean.

In the Centro de Estudios Educativos in Mexico, important studies have been completed, that first appeared in the Journal of the Centre (which would later become the Revista Latinoamericana de Estudios Educativos) and in specialized books(1). Pablo Latapi (1973, 1979, 1980, 1982) analyses the fundamental topics of Mexican education and organizes groups and projects relevant to the educational perspective of the country.

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(1) See for example Centro de Estudios Educativos (ed.) Educacion y Realidad Socioeconomica; 1979, Gonzalez R.J. Torres (ed.) Sociologia de la Educacion 1981.

5. Science, Technology, and self-reliance

Analyses of scientific and technological activities in Latin America have been conducted over the last two decades, especially concerning policies in the light of development alternatives and the condition of dependency(1). The authors of these studies maintain that in order to achieve self-reliance in science and technology it is necessary to create an infrastructure, to form human resources, to organize activities relevant to local, regional and national needs. Although it is true that in the past advances in technology have been relatively independent of those in the pure sciences and in organized scientific research, it is no less true that in the present -- and with greater intensity in the future -- technological development is the consequence of pure scientific and organized research. However, it is the conditions of the context in which scientific wisdom and technical knowledge are generated which truly dominate the dynamics of the process leading from nomological to pragmatic knowledge and to its application in the system of production.

That is, we are not dealing simply with planning on an abstract level, nor with development of scientific infrastructures on the one hand and production schemes on the other. There is a basic problem of policy research, and of interconnections between research policies and those related to the concrete activities of development.

This position was clearly presented in the declaration of the Symposium of Science and Technology which was held in Mexico in 1979 with the sponsorship of the UN Development Committee, the UN Department of International Economic and Social Affairs, the General Secretariat of the Conference of the United Nations on Science and Technology for Development, the United Nations Committee for Development Planning, the National Council of Science and Technology of Mexico, and the Colegio de Mexico. It was stated that

> "A framework should be elaborated that represents the necessary but not sufficient condition for creating in the long term some type of autonomous national capacity incorporating the following substantive proposals regarding the planning of science and technology:
>
> (a) whenever possible, science and technology should be included in long-term general socio-economic planning;

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(1) See for example Sabato, 1975; Sabato and Mackenzie, 1982; Leites Lopez, 1978; CONACYT, 1981; Wionczek 1982; Hodara, 1979.

(b) it should ensure a basic congruence between lines of scientific development and technological patterns on the one hand and socio-economic development strategy on the other, whether or not the latter is based on normal planning procedures; general planning of development can of course considerably facilitate the achievement of congruency;

(c) its principal objective should be to broaden the magnitude and improve the quality of the system of science and technology in order to further the research and experimental development that are pertinent to national socio-economic needs;

(d) it should give high priority to the task of diffusing scientific and technological culture throughout society;

(e) it should go beyond the spheres of research and experimental development actions as defined in the advanced countries, where the scientific and technological infrastructure is strong and diversified, and should construct such an infrastructure in the broadest sense of the term, so that it includes the improvement of education at all levels, the strengthening of information services and the creation of engineering consulting services;

(f) under no circumstances should it succumb to the mirage of autarchic production of technological wisdom and knowledge, in spite of its political attractiveness for some developing countries. For reasons that go beyond the common sense proposition that good science helps technological production, the developing countries need good science and pertinent technical knowledge. Science has other vital functions; one of the most important is to provide a general base for a more rational focus in the societies of countries that face the complicated and urgent problems of economic and social development."

The problem having been defined and the importance of technology having been recognized, the creation of a scientific-technological infrastructure was sought through such organisms as the National Research Council of Brazil, the National Council of Scientific and Technological Research in Mexico, the National Council for Development of Argentina, etc. With these were coordinated the activities of the educational sector that we shall analyse below.

However, it remains clear that the mere establishment of public and private organisms, that will supposedly generate science and then technology, which will easily flow to the productive system, does not solve the problem: there remains the important step of coordinating them with the activities of production. J. Sabato (1975) synthesizes some of the advances that resulted from the search for more concrete answers to such questions as the following:

- How, when, why and under what specific circumstances is the demand for science created?
- What are the relationships between science and technology?
- How do the supply and demand for technology flow through the various socio-economic circuits?
- Who do the results of scientific-technological research benefit?
- What are the relationships between technology and foreign investment?
- What is technological dependence?

The advances have an impact, according to Sabato, solely on the academic and the political levels; but little, we would like to add, on the levels of application or generation of science and technology.

Advances are seen in:

- recognition of the existence of structural obstacles to scientific-technological progress;
- recognition of the influence of technology in maintaining values;
- the in-depth study of the technology trade, based on the recognition that it is a valuable commodity in the productive system, and that for the most part, it is exchanged through commerce and not through free transference;
- confirmation of the fact that most of the imported technology has come in through direct foreign investment, and that the role of the transnational enterprises in the production and trade of technology is growing in importance;
- recognition of the growing 'technologization' of Latin America, as a consequence of industrialization.

Some of the still unresolved problems have to do with failure to achieve harmonious functioning of the productive structure and the scientific-technological infrastructure. As compared with purely scientific activities, that can be developed within the academic environment by universities and laboratories, technology is evolved in broader social spaces by diverse actors on the production scene, entrepreneurs and management professionals in the industrial sector, and farmers in the agricultural sector.

As we shall see in the case of many of the enterprises in the Industrial Port of Lazaro Cardenas that State, which is one of the great users of technology, does not define any appropriate middle- and long-term strategies. Our countries continue to be poor producers and heavy consumers of technology.

J. Hodara (1983) lists the restrictions in the organization of science in Latin America:

- the Latin American scientific community is small in size, weak in visibility and degree of autonomy, which complicates scientific accumulation, internal diversification, etc.
- resources (modest) are localized in the universities (with preference to teaching) and in some government ministries that do research;
- there is no infrastructure that would tend to create cycles of, or at least participation in, scientific accumulation;
- there is no 'critical mass', with leaders to connect the cognitive and sociometric links of the discuplines, that might facilitate interdisciplinary movements and the maintenance of a system of communications;
- there is a gap (too few and sometimes diminishing in relative figures) between the number of university graduates and the body of researchers involved in scientific careers;
- science has a fragile legitimacy, manifested both in the fluctuations in public funding and in the extreme cases of persecution or expulsion of scientists and elimination of centres of higher education;
- there is, as we mentioned before, a lack of communication between the scientific-research and the techno-industrial systems.
- scientific exchanges in the periphery are neither as intense, nor as frequent, nor as productive as those in central countries.

6. University policies and human resource planning in Mexico

The crisis in higher education, of equal or greater magnitude than that in scientific-technological systems, is made up of problems varying from re-examing the concept of the university as concerns financing, access, and relationships between the university and the State, between the university and the production structure. In the case of Mexico, the National Association of Universities and Institutes of Higher Education (ANUIES), the Subsecretariat of Educational Planning and Coordination of the Ministry of Public Education, and the National Council for Science and Technology (CONACYT) have determined planning objectives; but this does not mean that the basic problems of the system, diagnosed quite a long time ago have been solved. Among the unresolved problems are the following:

- little communication among the various universities and institutes of higher education. In 1977, ANNUIES stated "In the context of the system of higher education, it is observed that communication is insufficiently where relations between institutions are poor, and where there are differences, sometime great differences, between them. There is no common policy or working procedures, no operating agreements, no solid inter-institutional cooperation."
- a lack of efficient and viable planning based on regional and local priorities. The universities operate on the basis of their own individual priorities.
- an overemphasis on teaching and administrative concerns and little or no research activity. The universities of the interior, especially, are teaching centres, and the proportion of students that are not in university but rather in dependent schools of the upper middle level (preparatory schools) is between 50 and 80 per cent of the total state university enrolment.
- a shortage of skills, particularly in the professors and researchers, and a lack of dynamism and originality in the training programmes of academic personnel. Extraordinary growth in enrolment has imposed a strategy in which teaching capacities were minimized through the incorporation of quickly trained personnel. A further complication is the trend toward setting up post-graduate programmes without the appropriate teaching staff.
- little dynamism in the rapports between the university and its community, especially with the productive apparatus. With notable exceptions on the level of such universities as UNAM and the IPN, liaison with the provincial universities is little or nil.
- little evaluation of activities. In spite of a profusion of plans and programmes the evaluative activities are very informal and focused more on general concerns that affect the political direction than on evaluating programmes, setting goals, etc.

Planning on a national level faces one of its greatest obstacles in the excessive preoccupation of universities and institutes of higher research with their individual interests and the pressures of local politics on them. The universities (especially the state ones) concentrate under their control a significant number of preparatory schools (upper middle level of the school system), which contributes to pressure on higher-level enrolment, without resolving the problems of quality of teaching and training of students, most of whom will enrol in higher education.

Universities or institutes have existed in Mexico since colonial days, secularization did not begin until the early 18th century, and it was interrupted by the Wars of Independence at the beginning of the 19th century. During the periods of national organization, influences on the character and organization of higher education came from Europe, and especially, later on in the century, from the French encyclopaedists. The application of science and technology to the transformation of society through secularization, and especially through the introduction of large-scale communication (via railroads, ports, the telegraph, trucks, etc.) and the modernization of the country, reached the peak in the 'Porfiriato' and the association of the regime with positivistic scientists known ad the 'wisemen'. The University of Mexico was closed down by Maximilian in 1861 and did not resume its activities until 1910. The Mexican Revolution in 1910 which ended the 'Porfiriato' had as one of its components a deeply anti-scientific attitude that lasted until the thirties. The legitimization of science sought by Vasconcelos (Secretary of Education 1921) was not achieved until Lazaro Cardenas came to power (1934-1940).

In 1929 the National University of Mexico gained autonomy; in the thirties in the Institutes of Physics, Health and Tropical Diseases, Social Research, Economics, Law and Esthetics were created. The search for coordination on a national level began under Lazarto Cardenas as well with the National Council of Higher Education in 1935 (it disappeared in 1938). A Commission for the Promotion and Coordination of Scientific Research was created in 1942 under the government of Avila Camacho. The National Institute of Scientific Research was founded in 1950 and reformed in 1961. Ten years later the National Council for Scientific and Technological Research (CONACYT) was created to propose the national policies of science and technology, to assess technological requirements in the productive sectors, to encourage and support the development of research..

We see that the organization of scientific and technological activities and their diffusion is a fairly recent concern in Mexico, and its historical trajectory disjunctive. The abundance of plans and programmes and the repeated denouncements of the retardation of research and teaching and, at the same time, the lack of continuity of the programmes, the new knowledge about the nature of the problems and the need to confront them on more structural levels, are still issues to be resolved on operative levels which are still subject to ephemeral - especially partisan - interests and views.

Intellectual inspiration, the strengthening of scientific and technological activities and the very actualization of these activities are not random phenomena nor do they occur because one wants them to. From the organizational perspective, a number of situations have discouraged creativity, the formation of groups and exchange and communication between them. The dispersion and disorganization that characterize the present state of the development of science and technology also find their explanation in such conditions as the lack of intellectual leaders to coordinate, harmonize, and mobilize human and material resources; of reward systems that would favour the promotion of scientific activities, develop a community ethos and legitimize autonomy; of institutional mechanisms to protect investigation from partisan political games; of others that would favour the co-ordination of research in academic circles with that in the productive apparatus; in short, in the absence of the necessary conditions for retaining scientists and technologists (especially the leaders) in scientific and technological activities rather than transferring them (as is so common in Mexico) to administrative activities (especially in the public sector).

In spite of these restrictions important progress has been achieved in Mexico over the past ten or fifteen years, in the training of qualified personnel and the promotion of research activities. For example:

- on the post-graduate level, in 1970 only 635 research specialists were registered in Mexico; in 1977 there were about 3,000, and by 1982 there were 9,000. Mexico is a country which does not experience a high level of 'brain drain'. As a matter of fact it has received expert-level resources from all over Latin America. The positive Mexican balance might change, however, if the present economic crisis continues.
- CONACYT's scholarship programme for post-graduate work both in Mexico and abroad has been most effective in terms of volume. Between 1978 and 1982 it planned to award 17,000 scholarships, amounting to more than 3,000 million pesos; 36 per cent of the scholarships would be for Masters programmes, 27 per cent for technical training, 16 per cent for academic specializations, 11 per cent for thesis finalizations and 10 per cent for doctoral studies. Of these scholarships, 21 per cent would be in industrial areas (mainly the manufacturing industries), 17 per cent in the energy sector, 13 per cent in agriculture and 11 per cent in health and nutrition.
- in September of 1978, some 2,500 research projects were

sponsored by CONACYT, of which 28 per cent were in the priority fields of agriculture and forestry, 21 per cent in social development, 16 per cent in health and nutrition, 9 per cent in basic research, 8 per cent in industry; 4 per cent in construction and communications; 3 per cent in fishing, and 2 per cent in energy.

- the research projects established for the 1978-1982 period were aimed at evolving policies relating to the production of conventional and non-conventional energy; the necessity for achieving self-sufficiency in food production, the urgent needs for improving public health, reducing unemployment and achieving scientific and technological self-determination. Of special interest to the present study, the programme is focused on 3 areas and 39 branches, in which 4,335 research projects existed in the areas of:
  - (a) basic research: in the branches of physics, chemistry, biology and mathematics.
  - (b) oriented research: in the areas of food and agriculture; forestry, health, marine sciences, ecology, earth sciences, meteorology, information, space sciences, and social sciences.
  - (c) development and adaptation of technology: in the areas of food technology, energy, agriculture, cattle, forestry, agricultural machinery, mining, chemicals, telecommunications, transport, textiles, iron metallurgy, non-iron metallurgy, hydrology, electronics, metal mechanics, the automotive industry, pharmaceutical chemistry: the leather industry, timber, the paper industry, construction, instrumentation, standards, technological invention, library sciences, engineering and consulting services.
- Also of interest to this study is the fact that, of the 4,335 research projects supported by CONACYT in this period, 39 were in mining and metallurgy, 24 of these directly related to iron metallurgy and/or steel manufacturing. Of this group, six were in the Institute of Metallurgical Research at Michoacan University in San Nicholas de Hidalgo, in the macro-region near the industrial centre of Lazaro Cardenas.

- In technical education and research, 124 projects were mentioned, all under the Ministry of Public Education. These projects study relations among the various levels of the education system; the academic level of teachers; supply and demand in the labour market, with a special emphasis on graduates of the National

Polytechnical Institute, the regional technical institutes and the high-school level technical schools. In university education and scientific research, 50 other projects were reported, most of them related to problems of teaching, academic level of graduates, criteria for the decentralization of research activities. In educational planning, 52 projects were mentioned, mostly related to curriculum planning, human resource needs in various sectors of the economy, comparative studies, etc.

- The CONACYT programmes indicated other important initiatives in coordination with various institutes and universities; we are not aware of any evaluation of the results of these projects. Of the 39 mining and metallurgy projects mentioned above, ten included in their working teams members of more than one institute or organization. The research on low-carbon steel metallurgy involved the Ministry of Programming and Budget, the Ministry for the Patrimony and Industrial Promotion, and the School of Chemical Engineering and Extractive Industries of the National Polytechnical Institute. The team working on the development of alloys based on zinc and aluminium included the Department of Science and Materials of the IPN and the National Autonomous University of Mexico (UNAM) Chemistry Department and Materials Centre.

7. Middle level education and the policies of demand diversification in Mexico

The clarity of diagnoses of educational problems on the primary and higher levels is obscured on the middle level, where the crisis is just as acute, perhaps more.

The sudden tremendous expansion of secondary education, due to facilitated access, continuation of more students in the level, expectations of going on to higher levels in the system, etc., imposed the search for routes which would on the one hand give the middle level its own goal other than the consolidation of middle-class status or university preparation, and on the other hand channel demands for more education towards better harmony with the labour market.

The social function of the traditional middle-level school was the consolidation of status in the field of culture for very small fractions of the population (upper-middle and upper classes) through the 'bachillerato' (traditional high school comprehensive examination) and the normal school (preparation of primary-school teachers). Upon inclusion of middle, working and peasant classes (first in the large urban areas and then in small and middle-sized cities) these schools would experience an internal trend toward heterogeneity that, rationalized on the basis of supposed needs of the job market, would correspond closely with the new heterogeneity in the social composition of the student populations. The diversification of the supply of middle-level schools will come about through educational reforms that promote the creation and strengthening of industrial, commercial, agricultural and fishing schools. These technological schools, which prior to the reforms absorbed very small segments of the population, and which in their origin and curriculum organization correspond closely to the terminal schools of arts and trades, received new status and intense development in Mexico, starting in the 1970s.(1)

The trend toward heterogeneity in the productive apparatus creates a demand for greater educational qualifications, first in the tertiary sector of the economy and then, in a weaker but no less important form, in the secondary sector -- all in highly urbanized areas. This heterogeneity is still very limited in the primary sector, however.

With the generalization of middle-level instruction the guarantee of consolidation of middle- and upper-class status is greatly weakened, and is transferred to higher levels. In spite of this, the new heterogeneity still retains the old social attitudes inherited from the past (particularly in modalities associated with manual versus non-manual activities) -- attitudes that would be reinforced if the authorities attempted to give technological education and moreover a terminal pragmatic rather than theoretical, character. Furthermore, the job markets after the primary and secondary levels are too rigid to absorb growing numbers of graduates, and more important they offer low remuneration.

Educational reforms that have tried not only to anticipate the dynamics of the market and the economy but to attack the rigidities of the traditional structure of middle-level teaching (especially its abstract encyclopaedic and bookish nature) propose changes that, oriented toward the pragmatic, restructure the curriculum in favour of concrete trades. They were not in fact technological schools in which students would be involved in 'scientific and technological culture' (perhaps as opposed to 'humanistic and literary culture'), but rather trade schools that sought to provide the students with specific skills for which results are more important than principles. Thus in fact the market is offered trainees from two types of schools: one, the traditional, whose values (even the positive ones) are rejected by the planning organisms; the other, supposedly pragmatic and technological, some with the explicit goal of being terminal schools, i.e. schools not allowing the incorporation into higher or university levels.

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(1) See Urquidi, Victor: "Technical Education in Mexico: a Preliminary Appraisal", in Prospects, Vol. XII, Num. 1, 1982.

The problems arising from the dichotomy relate then not only to the concepts of the education provided in them but to the channelling of demand according to the social origins of the students -- the middle and upper classes toward an encyclopaedic university-entrance education, and the popular classes toward a pragmatic education and early termination.

Later reforms in Mexico led to homogeneity in the first half of the middle cycle (basic) in terms of content, and to the prolongation of basic schooling from six to nine yers; the whole technical system (perhaps with the exception of some private schools) continues to reflect a generalized image of low-quality studies. The experience in other countries demonstrates that commercial, industrial, and even agricultural instruction becomes attractive when its academic levels are as high or higher than those of the general secondary schools, when the labour market absorbs its graduates at satisfactory levels of income, and, above all, when it opens up to its students unlimited possibilities of access to the higher levels in the system. Early specialization itself scarcely benefits society or individuals; the productive structure may not permit the incorporation of the graduates, and its dynamics demand greater flexibility to cope with occupational changes. The necessity, then, for differentiating between general education and job-training, between the responsibilities of the working environment and those of the school, is urgent.

8. Synthesis

The ways of understanding the contributions of education and of training systems to industrialization, development, and technical progress vary in function with the philosophies of education that are held, and with the future plans of the groups in power for the society. In Latin America, belief in the reforming power and capacity of the school and its potential to generate progress is a constant. The first emphasis given the role of education was in the formation of responsible citizens: later it acquired an economic role, which was affirmed starting in the fifties in the plans and programmes of specialized government agencies, with the aim of establishing conditions that will facilitate a transition from traditional to modern society. The theories that justify and maintain the thesis of modernization and transition by stages are functional-structuralist and human-capital theories, highly attractive in the period between 1950 and 1970.

The need for industrialization, questioned in the second half of the 19th century, was strongly supported by the diagnoses of CEPAL, and in order to ensure it, it would be necessary first to absorb technological acumen -- initially through foreign investment, later by generating local innovations. Education would have an active role in these programmes, and the promotion of its growth would be accompanied by a series of technical recommendations coming from specialized agencies, to orient the policies destined to promote social equality and the efficient training and utilization of skilled human resources.

The extraordinary growth of the capitalist economy in the central countries during this period was offset by a continued worsening of the situation in the peripheral countries, accompanied by waves of instability and crises that periodically challenge the possibility of development itself.

Plans and programmes that accompany and contribute to formidable increase in enrolment at all levels of the educational system began to be severely criticized in academic circles, which tended to focus on problems related to the social division of labour and the effects of the external environment unresolved by a school system claiming to be based on the promotion of social equality and suitability for the labour market.

The enthusiasm generated in the fifties for the transforming capacity of education, is of course suffering a profound depression. The research on the criticism of the 'failures' of the educational system has discovered four illusions: that of equality of opportunity for all, that of liberty and democracy, that of progress, and the capacity of technical progress to solve the problems.

The 'technocratic' model is severely criticized, both in its general suppositions and in the corollaries derived. The critics are very fertile in pointing out deficiencies, but less effective in suggesting alternatives. The most radical options propose deschooling utopias that are impracticable. The less anarchic radical criticism proposes socialist-school models or radical changes in the overall society, but do not have the necessary power to convince the agents traditionally entrusted with leading the revolutionary process. Politization and radicalization in the entire system of middle and higher education often result in problems that may have an impact on the environment outside the school in a manner highly disruptive to the internal organization of the system, and may affect the quality of instruction.

In this sort of environment, intellectual and instrumental components at all levels tend to polarize. Political mobilization in general require that instrumental components be subordinated to intellectual ones, with the result that ideology and critical conscience overshadow the instrumental component of learning to do things and to do them well; the authoritarian answer of demobilization -- no less catastrophic -- proposes separation, equally categorical, between creativity and critical conscience (which should not be encouraged) and instrumental components (which should occupy the entire educational process).

Disagreement among experts about the scope of the educational process and the crumbling of bases of agreement as to the role of education, generating an intellectual crisis, is partly transferred to the actors involved in the system. These disagreements can be synthesized as loss of purpose, loss of cultural continuity, uncertainty of what is important, what is superficial and what is accessory. For a while, ideologies polarized on the one hand around technocratic-instrumental styles from the planning agencies, on the other, around critical-normative styles in academia, both side claiming objectivity, and especially scientific justifiability.

But not everything is in a state of crisis. Analysis and criticism has not always focused on the catastrophic extremes. Plans and programmes now reflect the necessity not only for regulating the growth of the system in more appropriate ways, but for exploring the potential of models that take into account different styles of development, encourage the acquisition of knowledge, creativity, and innovation on the technological level, maintain objectives of development as the satisfaction of basic needs, promote self-reliance and the use of an 'appropriate' technology that does not scorn advances in productive capacity, etc.

In this way a more solid scientific-technological infrastructure is promoted that seeks integration with the productive schemes through policies and strategies for development and research that are better suited to national and regional needs.

There remain, however, serious problems in certain areas: in educational organization, in science, and especially in the effective implementation of plans and programmes.

2. THE EDUCATIONAL SYSTEM IN MEXICO

1. General characteristics

The formal Mexican educational system is organized in levels along with informal and non-formal school types, these levels are grouped according to technological and general modalities; terminal and non-terminal types; and to federal, state, autonomous and private areas of control.

The formal school type is that which has a predetermined curriculum, is subject to a calendar and timetable, has a school building, with classes under the direction of a teacher, etc. For entrance into the lower and middle levels, and even in some cases to the higher, there are requirements as to minimum and maximum age and the successful completion of previous levels.

In informal schools, the calendar is flexible with respect to hours and duration; in general the students work at home (in the best of cases with the help of the mass media such as radio and television); the programmes are usually directed toward urban and rural marginal populations and workers.

Non-terminal systems permit students to pass from one level to another after fulfilling the requirements of the lower level. Branch-like structures of the system may permit the student to change from one type or even modality to another or from one career to another; but some of the paths of possible ascent are predetermined - in fact, in practice, and in regulation - within specific specialities or modalities.

Terminal systems are those which do not qualify a student to advance to higher levels in the formal or informal school system.

Fishing, agricultural, and industrial/commercial schools are of the technological type; terminal systems are generally of this type. They are designed, on the basic middle level and higher middle level to qualify technicians, and in centres, regional technological institutes, and the National

Polytechnical Institute, to provide the middle-upper and upper levels. All come under the jurisdiction of the National System of Professional Technical Education, with the exception of the National Colleges of Professional Technical Education, created in 1978, that operate autonomously and award final technical professional degrees in more than seventy specialities on the middle upper level.

The general modality, of a traditional type, does not certify specialities; the basic middle level corresponds to a general 'secondary' level, the senior high school or middle upper level to the baccalaureate. Studies are preparatory to university entrance.

Federal Public schools are controlled by the Federal Government, State Public by the Governments of the Federative or State Entities, and private by individuals or private organizations. On the higher level there are public universities and institutes which can be state, autonomous, or decentralized, and private ones under the control of religious organizations.

By levels (see Fig. 1), the services of the system are:

i. - Special programmes
  - literacy
  - Spanish (for indigenous populations)
  - special education

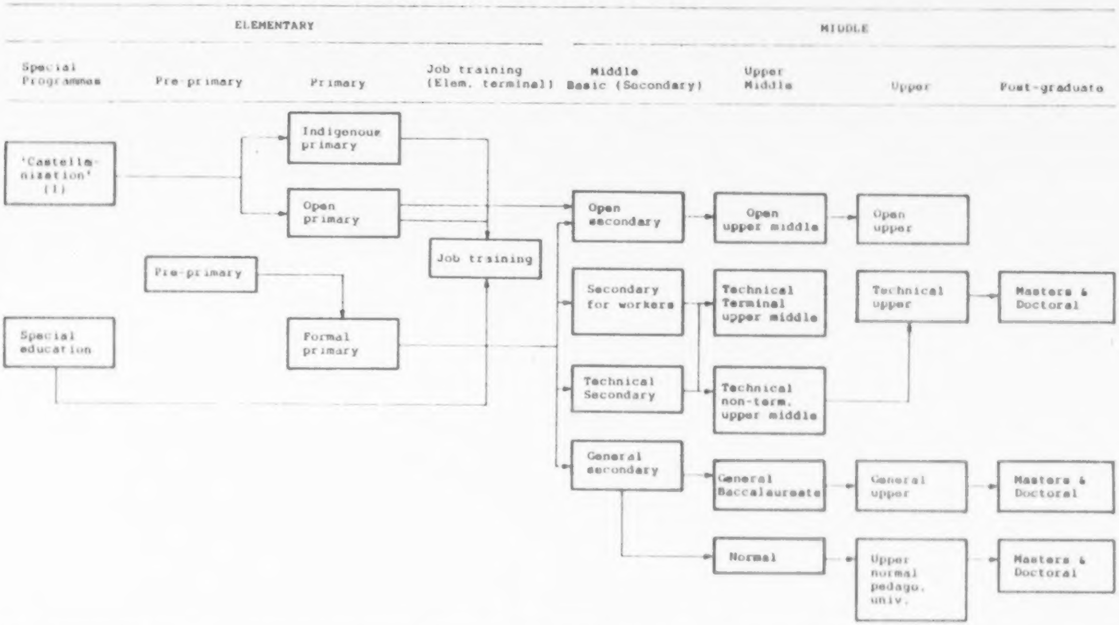
ii. - Pre-school level: 3 - 5 year olds
  One or two classes in Kindergartens and also day-care centres are offered to children under 3.

iii.- Primary education:
  - Formal: for the 7 - 14 year-old population, legally compulsory for 6 school years.
  - Indigenous: primary schools taught in Spanish, bilingual schools, and open systems.
  - Open: for the illiterate adult population

iv. - Job training
  - programmes recognized by the Ministry of Public Education (SEP), courses varying from 20 to 40 weeks.
  - sub-professional schools, from 2 to 3 years in duration (academies), generally not recognized by SEP.
  - specialized practical school (3 months to 1 year), not recognized by SEP.
  - schools for the development of skills (variable in duration), not recognized by SEP.

v. - Secondary education - 'secundaria' of 3 years duration
  - General
  - Technical

Figure 1. Flow chart of the Mexican educational system (Theoretical and formal)



(1) The teaching of Spanish to indigenous populations.

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- for workers (older than 15 years)
- open (non-formal adult school)
- telesecondary (for adults, mixed with semi-formal systems).

vi. - Middle-upper education: "Bachilleratos" or "Preparatorias" (university entrance, 2 - 3 years' duration).
- General
- Technical
- Open
- Terminal Technical
- Normal (primary school teachers trained in 4 years).

vii.- Higher education: professional studies
- Higher (universities)
- Technical (polytecnnical and technical institutes)
- Open (in universities and technical institutes)

viii.- Post graduate higher education
- masters and doctorates (throughout the higher-level system except open)

2. Satisfaction of demand, by level

In the last 25 years -- and especially in the last decade -- the overall school population, formal and non-formal, has grown at rates much higher than those of the natural and social growth of the population at large.

For 1983, almost one out of every three Mexicans was enrolled in some level of the educational system, and the Ministry of Public Education proclaimed that the demand for primary education was satisfied. But the SEP data are not very reliable, nor are the criteria of satisfaction of demand. In a previous study where we analysed problems in greater detail, we pointed out that in addition to the political problems involved the supply of and demand for educational services, there were problems such as geographical isolation (more than 55,000 hamlets of less than 100 inhabitants), the accelerated growth of the population, and others that made it difficult to offer even a basic education through the conventional systems. [Padua, 1979]

Provisional data from the 1980 General Census of the population -- also unreliable -- indicated that there were between 6 and 8 million illiterates in Mexico (representing 15 to 21 per cent of the population over 14 years of age), and that in the same age group between 12.5 and 17.3 million people had less than 4 years of primary education; 15 million had not completed primary school and 7 million more had not completed basic middle school. The national literacy programme established by the SEP in 1981 with the aim of rapidly making one million adults literate, fell to the fate of the massive programmes attempted earlier. Of the 1.6 million persons initially incorporated, only 10 per cent actually became literate (164,000 adults). Lic. Jaime Pena Zazueta, who was in charge of the programme, declared in an interview [Proceso, March 28, 1983] that it failed not only because 75 per cent of the enrollees abandoned the programme because of incompatible work-schedules and badly-planned locations, but also because materials and methods were ill organized, teacher training inadequate, and the concept of the programme itself deficient.

The distribution of illiterates in 1980 and 1981 is given in absolute numbers in Table 1.

In spite of enormous growth in the educational system, retardation is very serious. An idea of the task to be confronted is given by the educational profiles of the economically active population taken from the 1970 Census, in Table 2.

The opinion that illiteracy is fundamentally a rural problem (affecting above all, the female population) was confirmed to a degree in an earlier study by the fact that the immense majority of the unschooled or almost unschooled population enters economic activity in the countryside, and the characteristics of the branches of the economy themselves tend to concentrate the lower levels of education in those urban activities where the entrance of immigrants from the country-side is easiest (domestic service, the food industry, routine manual activities). In the agricultural branch Table 3 shows the poor educational profile of the labour force 12 years of age and older in 1970.

Table 1 - Distribution of the illiterate population 15 years of age and older

State	1980	1981
Aguascalientes	28 386	28 356
Northern Baja California	72 616	72 570
Southern Baja California	11 222	11 210
Campecne	38 948	38 906
Coahuila	83 838	83 748
Colima	30 366	30 333
Chiapas	374 302	373 901
Chihuahua	106 282	106 169
Distrito Federal (Mexico City)	396 730	396 322
Durango	68 654	68 581
Guanajuato	446 258	445 780
Guerrero	402 028	401 598
Hidalgo	234 351	234 100
Jalisco	340 635	340 270
Mexico	615 916	615 240
Michoacan	425 794	425 338
Morelos	101 662	101 553
Nayarit	71 955	71 878
Nuevo Leon	114 205	114 082
Oaxaca	444 278	443 802
Puebla	471 344	470 839
Queretaro	104 303	104 191
Quintana Roo	14 523	14 507
San Luis Potosi	191 441	191 236
Sinaloa	173 617	173 431
Sonora	88 459	88 365
Tabasco	106 284	106 170
Tamaulipas	128 068	127 931
Tlaxcala	50 171	50117
Veracrux	667 441	666 692
Yucatan	125 428	125 293
Zacatecas	71 955	71 878
Totals	6 601 460	6 594 387

Source: Sixth Presidential Report, 1982.

Table 2 - Educational Profile of the Economically Active Population (12,955,051) by Sex and Educational Level in 1970 (in %)

Sex	Masculine	Feminine	Total
No schooling	28.11	23.10	27.16
1-3 years primary school	31.88	22.49	30.09
4-6 years primary school	27.93	37.78	29.81
Jr. high or pre-vocational	5.54	5.61	5.55
High school or vocational	1.84	1.76	1.82
Sub-professional with high school	1.31	6.80	2.35
Professional	.17	.27	.19
Professional with university degree	3.22	2.19	3.03
Total	100.00	100.00	100.00

Table 3 - Educational levels of the agricultural labour force (4,641,320) in 1970 (in %)

Total	100.00 (4 641 320)
No schooling	44.33
1-3 years primary	39.37
4-6 years primary	14.51
Jr. high or pre-vocational	1.18
High school or vocational	.17
Sub-professional with jr. high	.08
Professional	.06
Higher than professional	.28

The educational system in Mexico

The following is an account of the advance of the system in recent years. For the purposes of this study, technological education in the basic middle, upper middle, and university levels will be described in greater detail.

i) Special programmes

Some aspects of the adult literacy programmes have already been described. Castellanization centres for the indigenous population that began in 1978 with an enrolment of 65,720 students had 135,500 by the 1981-82 school year, with 5,518 teachers operating in 4,229 centres. Important advances are being made in the special education system that 31,696 children attended in 1980, the majority in integrated groups in which Alterations of Intelligence (61.06 per cent), Alterations of Adaptation (28.61 per cent), and Alterations of Communication (15.46 per cent) were diagnosed.

ii) Pre-school level

With the growing levels of urbanization in the country and the formal participation of women in the labour market, and with the increasingly frequent demand of some schools (especially the private schools) that children enter the primary cycle with specific skills (almost a prerequisite of enrolment), the pre-school level absorbs increasingly more important proportions of the 4-5 year old population. This phenomenon has been noted particularly since 1970. In the 1982-83 school-year, 39.8 per cent (4,601,661) of the pre-school-aged children were enrolled; 69 per cent of them in state schools.

It is the private schools (which have 12 per cent of the enrolment) where scholastic criteria are the strictest, and children graduate from this type of school with fairly well developed skills in reading and writing. In the majority of the state schools, especially those attended by middle-class children, some ability to read and write is required. Here the function of the day-care centre is predominant.

There is, then, a problem of extending formal schooling, which middle- and upper-class children are entering at four years of age.

iii) Primary level

The expansion of primary school opportunities has been continuous and intense over the past two decades. In 1930 only 38.1 per cent of the school-aged population was absorbed into the educational system and in 1980, according to the SEP, 98.0 per cent was absorbed (see Table 4).

Table 4 - *Expansion of the primary schools*

Year	Demand (No. of primary school-aged children)	Absolute Demand (actually enrolled)	Satisfaction of Demand (in %)
1930	3 413 900	1 299 900	38.1
1940	4 501 800	2 111 500	46.9
1950	6 501 100	3 030 400	46.6
1960	8 056 400	4 762 100	59.1
1970	12 041 200	9 248 200	76.8
1976	14 020 000	12 026 200	85.8
1980	14 965 600	14 666 300	98.0
1982	15 550 200	15 239 200	98.0

Source: Secretary of Public Education 1979 and 1982.

The criteria for 'satisfied demand' are computed from insatisfactory bases in the calculations. In fact, they would give the impression that penetration by age group was complete in all the regions and through all levels. We know very well that there are many problems, related not only to *access* of school-age children to the system (a large percentage of rural schools still offer only 3 or 4 years of schooling) but to their staying in the system long enough to complete the cycle. *Dropping out* is clearly a serious problem (about a million children abandon primary school annually) as is *failure* and *repeating classes* (10 per cent of the children enrolled in 1980 were repeating a grade), and especially *completion efficiency* (only 48 per cent of the children that begin primary school manage to complete the 6 year period). Dropping out is especially notable in the earliest years; it is partly related to the quality of schooling offered in rural zones, and to repeating grades (which tends to inflate the statistics). In another study (Padua, 1981), we measured the school wastage on the primary and middle levels of the system to prove the hypothesis that mechanisms of social discrimination were found not only *between* levels of cycles but also *within* each level. By examining the 1970-76 school records, we find the following rates (Table 5).

Table 5 - Primary level dropout rate

School year	Total students	Percent of loss	
1970-71	2 693 142 (1° grade)		
1971-72	1 921 566 (2° grade)	28.65%	Total dropout for the cycle: 57.13% 87% of the graduates in 1976 enrolled in the middle level of the system
1972-73	1 687 660 (3° grade)	12.17%	
1973-74	1 468 626 (4° grade)	12.98%	
1974-75	1 270 529 (5° grade)	13.49%	
1975-76	1 154 490 (6° grade)	9.14%	

The same phenomenon was observed in the middle cycle of the system (grades 7-12). Calculating only the secondary school enrolment for the basic level and all the types for the upper level, we find the following rates (Table 6).

Table 6: Basic middle-level dropout rate

School year	Total students	Percent of loss	
1970-71	459,942		
1971-72	397,077	13.67	Dropout rate: 23.19%
1972-73	353,260	11.04	
Middle-higher			
1973-74	280,067		79.28% enrolled in middle-higher level Dropout rate: 46.22% 140,275 enrolled in higher educ. in 1976 (180,340) requested enrolment
1974-75	214,244	23.50	
1975-76	150,630	29.69	

Note: 180,340 requested enrolment in higher education in 1976; 140,275 actually enrolled.

In the middle-level cycle as a whole, we have a dropout rate of 67.25 per cent (1970-76). Naturally, these calculations contain some errors, especially over-estimations in comparisons of dropout rates based on the total enrolment between one and another school year, since the number of students repeating the year is not taken into consideration. However, it is still true that the level requires greater attention, because the children (especially the rural ones) are receiving neither the quantity nor the quality of education defined as basic.

In the 1981-1982 school year, enrolment was as shown in Table 7:

Table 7 - Primary education enrolment 1981-82

	Absolute Numbers	%
Formal primary		
Federal	10 175 703	67.92
State	3 465 618	23.13
Private	760 300	5.08
	14 401 621	96.13
Indigenous primary	384 721	2.57
Primary community courses	194 686	1.30
	14 981 028	100.00

Source: Sixth Report of the Government of José Lopez Portillo, Education Sector, Mexico, 1982.

The same year, the system of open schooling gave some type of examination in the various grades of the cycle to 142,185 persons, and awarded 6,204 certificates of completion of primary school. At the same time, the Centers of Basic Education for Adults, which had served 183,295 students in 1981-1982, had 35,489 graduates. Thus the system operates fundamentally on the basis of formal schooling (98.7% of those enrolled, if we include primary school for the indigenous population); the open systems that have operated since 1976, had, by 1982, awarded a total of 27,141 diplomas or certificates; as we will see later on, this same open system awarded more diplomas on the secondary level.

iv) The job-training systems

In 1970, Article 132 of the Federal Labour Law established the obligation of owners of enterprises to permanently or periodically organize programmes for the professional or skill training of workers, in agreement with them or with the unions. The programmes could be implemented in each enterprise or serve several together, located in one or various establishments, departments or sections, and taught by members of the company's staff or by personnel especially contracted through schools, specialized institutes, or any other organizations. The initiative was left principally in the hands of the owners and managers, and it was only the large enterprises that developed systems functional to their needs and interests.

The public sector began to participate in organizations such as ARMO (Rapid skill-training of labour) and CENAPRO (National Centre of Productivity); and the programmes of the IMSS (Mexican Institute of Social Security), the IPN (National Polytechnical Insititute), and CECATI (Centre for Labour Training). A number of private organizations have been created since 1970.

In 1978, the law was reformed to strengthen the role of the government in regulating services, while the functions of the formal systems were promoted and broadened through terminal schools (see Chapter 6).

The reforms worked out in Article 153 of the National Labour Law establish:

- the right to training and to the participation of workers in the formulation of plans and programmes, specifying location, time schedules, type of personnel that will provide training, etc.;
- the objectives of training (updating, self-improvement, preparation for vacant positions, on-the-job accident prevention, productivity increase, skill development, etc.).

UCECA (the Coordinating Unit for Employment and Training) was created, along with its subunit, the National Service of Employment and Training. In 1980 enterprises registered 9,379 plans and programmes (3.17% of the total number of enterprises) with UCECA. That same year, 616 training entitites with 528 training programmes oriented toward production were registered, 452 toward administration, finance, accounting and legal affairs, 459 toward the development of human resources, 319 toward sales, marketing and publicity, and 333 toward various services; 3,101 external instructors in these training centers were registered (see Mexico, 1982a).

Modalities of training and capacitation: The large private industries have a long tradition of internal training systems, patterned after the models of the transnational companies (Ford, Nestle, Volkswagen, Nissan, etc.). The public and para-state sectors (the Mexican Petroleum Institute, the National Electrical Commission, SIDERMEX, the Institute for Training in the Sugar Industry, etc.) have their own training centres.

In the public sector, ARMO and CENAPRO have broadened their services throughout the country and into the commercial, service and agricultural sectors. CENAPRO trains administrative and management personnel (production technicians in industrial engineering, in economic administration, in merchandising, finance, personnel policy, etc.). They undertake studies of productivity, offer consulting services and diagnoses of the productivity of medium and small companies (1). ARMO trains workers within the companies.

A study of a sampling of companies in 23 cities (Revista Mexicana, 1982 (2)) in the food, textiles, rubber, metal mechanics, publishing, and construction, commerce and service industries, among others, showed that:

- resources allocated by the companies for training were insufficient, 70% did not include training in their budgets, 22% assigned funds up to 100,000 pesos per year (approximately $4,000 dollars);
- the commonest method of training is "learn by doing";
- the functions of the Mixed Commissions for Capacitation and Training are more apparent than real;
- capacitation and training activities are limited by the lack or low levels of schooling of the labour force (42% of the skilled operators and 62% of the unskilled had between 4 and 6 years of schooling);
- the rotation of personnel in the companies (24-30% of the technicians and skilled and unskilled operators rotate from one company to another annually) implies continued training or retraining for new situations;
- the entrepreuneurial sector considers that it is the function of government and of the school system to train the labour force, exempting it from any training obligation;
- the worker perceives training as benefitting the company, not him. It is often the unions that violate the regulations in favour of the companies;
- it was found that the training units included in the sample trained an average of 721 persons, or 43% of their capacity;
- it was the unskilled workers who received the least training.

Job training offered by private services (6,500 schools registered, of which only 8% were recognized by the SEP) is provided at the (basic and upper-middle level) schools recognized by the SEP, in sub-professional schools (academies) not recognized by the SEP in 2- to 3-year career secretarial, mechanics, drafting, accounting, language, computer courses among others, in specialized practical beauty, dressmaking, cooking, and interior decorating schools, and in schools for the development of talents and skills such as singing, dancing, guitar, piano, karate, etc.

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(1) Under the present administration, CENAPRO's activities and programmes are under revision.

(2) Revista Mexicana de la Construccion N° 327, Enero, 1982, Mexico.

A 1979 study of some of the sub-professional and specialized practical schools (Procuraduria Federal, 1979) found that:

- none of the schools officially recognized the courses completed;
- 65% of the teachers were 'practicums' - student teachers without academic or pedagogical training or formal studies;
- 63% of the students used these services for rapid selfimprovement that would allow them access to better-paying jobs;
- the age of the students was 20-30, with an average income of 6,000 pesos (240 dollars) monthly;
- 25% of the students were satisfied with the training received and 75% were not; 90% were satisfied with the installations.

Meeting the demand for job training: Training centres filled 13.1% of the demand (taken as the number of graduates from the primary schools) in 1972, 17.3% in 1981. The schools that offered training courses doubled over the period, going from 1,322 in 1972 to 2,898 in 1981, with enrolments of 180,803 and 395,192 respectively. As stated above, the private schools have the greatest enrolment, and a tendency to grow (see Table 8).

v) Basic middle level (secondary)

Along with the upper-middle and university level, this level grows at an intense pace, and has a terminal efficiency superior to that of the primary level (72% in 1976).

Considered by the SEP as a part of basic education (with the pre-primary and primary levels) which is thereby extended to 9 years of formal schooling, its growth is in fact more an expression of social demand for education in the urban sectors than of plans and programmes prepared by specialized agencies.

Until the fifties, this level consisted mainly of junior high-school education in the general or traditional sense. But since then, experience in the application of modernizing concepts has grown, through the creation and broadening of technological modalities of the 'vocational school' kind

Table 8 - Training Programmes: Enrolment by type of institution (in %)

Control	1972-73	1973-74	1974-75	1975-76	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Federal	19.7	19.0	18.6	17.8	12.4	12.3	13.1	13.2	12.5	12.0
State	14.1	14.1	14.9	12.8	12.9	12.7	11.7	10.6	9.0	8.0
Private	66.2	66.9	66.5	69.4	74.7	75.0	75.2	76.2	78.5	80.0
Total enrolment	180 803	194 702	204 260	243 974	244 382	245 688	249 993	254 384	369 274	395 192

Source: Mexico, 1982a.

which would later become school or career directions into the senior high school or into university levels either in the Regional Technical Institutes or the National Polytechnical Institute.

The percentages of real demand (graduates of primary school that enter the first year of high school) have grown significantly in recent years: 69% in 1965, 77.8% in 1980, 90% in 1982 (SEP statistics).

Table 9 - Growth and composition of enrolment, by modality and type of institution, 1970-1982

	1970-71	1975-76	1980-81	1982-83	Gross Rate of growth 1970-82
State	186 806	294 149	476 760	648 694	247.26%
Private	310 204	490 505	524 365	522 914	68.75%
Federal	605 207	1 113 399	2 032 731	2 546 482	320.76%
- General	421 255	682 676	2 282 945	1 536 940	264.85%
- Labourers	50 183	78 937	130 578	153 929	206.74%
- Telesecondary	29 316	44 832	73 399	116 623	297.81%
- Ind/Comm.	87 637	182 261	310 773	427 477	387.78%
- Agricultural	16 816	119 510	228 593	301 858	1695.06%
- Fishing	-	5 183	6 443	9 655	86.28%
TOTAL	1 102 217	1 898 053	3 033 856	3 718 090	237.33%

The most noteworthy tendencies observed in Table 9 are the following:

- the extraordinary growth in enrolment, more than tripling in 13 years;
- increases in federal as compared to total enrolment (from 54.91% in 1970 to 58.66% in 1975 to 67% in 1980 to 68.49% in 1982), and the decreased enrolment in the private schools (from 28.14% in 1970 to 25.84% in 1975 to 16.28% in 1980 to 14.06% in 1982);
- although tendency to decrease enrolment in the federal secondary schools (69.61% in 1970; 60.36% in 1982), still constitutes more than two-thirds of the total secondary enrolment;

- the extraordinary growth of the technical agricultural schools, which we will discuss further in the section on technological education;
- the slow growth in fishing school enrolment over the period should be merely a response to the low dynamics of the fishing sector in a country with an enormous coastline.

Finally, in the Open System in 1981-1982, 215,125 candidates took at least one examination, and 10,771 certificates of completed secondary education were awarded. Between the beginning of this type of programme in 1976-1977 and 1981-1982, 39,110 certificates were issued.

vi) Upper middle level

Of the priorities agreed upon by the SEP authorities in their Programmes and Goals for the Education Sector, 1979-1982, for the achievement of greater diversification in an educational supply still dominated in enrolment figures by the 'preparatory' course for the baccaulauréat, the following were given special attention: a) to raise the 9% proportion of students enrolled in terminal-type studies in the upper middle level to 20%; b) to increase the proportion of those graduating in relation to those enrolled to 70%; c) to improve the prestige of this type of career.

The programmes envisaged the encouragement of professional education in the upper-middle level (technical senior high school), and the coordination of a better type of university upper-middle education by promoting technological industrial upper-middle including services, agriculture, and fishing, and establishing as a goal for 1982, the following:

- to provide upper-middle education to 940,000 students in autonomous, state, private, and other universities (presumably of the traditional baccalauréat type);
- to provide upper-middle level education under federal jurisdiction in:
  - industry and services - 140,000 students in the non-terminal system, 35,000 in the terminal
  - agriculture - 70,000 students
  - fishing - 12,000 students;
- to provide technical education in the National Polytechnical Institute to 96,000 students in the terminal and non-terminal systems.

With minor exceptions, the goals have been fulfilled. The system has grown at a velocity greater than expected, and only the agriculture and fishing sections have not managed to enrol the hoped for quantities. Terminal studies effectively enrolled 19.23% of the total general enrolment, representing a more than tenfold growth over the 1970-1982 period. The goal of 20% was virtually reached, the other modalities also grew rapidly, especially the non-terminal technical studies. The growth of normal education over the period, while very significant, began to decline as of 1981-1982 school year, especially in the private schools.

Absorption of the real demand was an extraordinarily high 98% but it must be remembered that the calculation of this demand is based on the total quantity of graduates from the previous level, which tends to over-estimate the figures.

Federal goals for the technical sector were far better than met: they were doubled (see Table 10).

vii) Higher and post graduate education

The system of higher education which in 1959 comprised 70,728 students in Mexico, grew to 194,090 in 1970 and 1,074,601 in 1982. Over a period of 23 years, enrolment grew by 15 times. The 'élite' university of the fifties can now be considered a university of the masses - at least in the more developed regions of the country. The growth trends that will continue in coming years will be especially notable in the states undergoing rapid processes of urbanization, where in recent years basic middle and upper middle education has been implemented.

The growth in university enrolment over the past ten years seen in Table 11 points out:

- a sustained and rapid growth in the total university population, tripling enrolment in ten years (over the 1970-1982 period, enrolment grew 514%. The federal institutes, whose specializations are mainly technical, are those that grew most impressively (6-1/2 times the enrolment of 10 years ago). The Upper Normal also grew rapidly (4-1/2 times) and in 1982 included 11.85% of the total enrolment in the upper level);
- a decrease in enrolment in the National Polytechnical Institute (IPN) which until 1975 captured 70% of the total technical enrolment in the country, but which presently finds very strong competition in the federal university institutions (as we will see below, there is nonetheless a relative decrease in the branches of engineering and technology, as well as in the natural and exact sciences, relative to other areas in the general composition of enrolment);

- a stabilization in enrolment (very small in volume and comprising two schools) in specialized normal education;
- a proportional decrease in the enrolment of the National Autonomous University of Mexico (UNAM) which in 1960 made up 58.42% of the entire university population of the country (in 1972 it was 24.61% and in 1980, 14.02%);
- an increase in the proportion of the total enrolment in state universities and institutes, which by 1980 represented 46.95% of the total enrolment (this has a very strong significance in qualitative terms, since it would indicate not only a deconcentration in nationwide enrolment, but also important changes in the power structures of some centers on the national level;
- a stabilization in the proportion of the total enrolment accruing to private universities (13.76% in 1972; 13.79% in 1982) although the proportion of graduates to the number enrolled was significantly higher than that of UNAM, for example (see Table 11).

There has been a significant decrease in the weight of the Federal District (Mexico City) in the educational supply on the upper level, but only in relative terms. As we observe in Table 12, the rate of participation of the 20-24-year-old population in higher education enrolment, after growing to an astonishing 27.22%, shows a decrease in 1980-1981 to 21.53% - which is still very high. The rate of participation on the national level grows consistently with vigorous acceleration in the 1970s. The Federal District has a very high participation rate - approximately one out of every four 20-24-year-olds is attending university. In the 1960s, the Northern zone of the country had only one-fourth the rate of participation of the Federal District's in this age group; in the eighties its rate is almost equal. Growth in the various zones is so rapid that, with the exception of the Federal District, the lowest rate of participation in 1980 is higher than the highest rate in 1970. If this tendency continues national participation rates in the next decade could reach around 20%.

The terminal efficiency of the upper level showed indications of deterioration as, according to SEP data for the 'licenciatura' level a calculation of 5-year cohort for the 1967-1974 period indicated that the efficiency rate lowered from 58.2% to 39.7% (Table 13).

Table 10: Upper-middle level enrolment in various specializations by type, 1970-1982

Specialization and type	1970-71	1975-76	1980-81	1982-83	Growth rate 1970-82
Baccalaureate					
Federal					
Industrial Tech.	63 946	146 893	245 060	371 339	480.71*
Farming Tech.	73	14 962	37 459	45 774	205.94*
Fishing Tech.	59	739	4 179	...	
...					
Total	64 178	162 594	286 698	417 113	550.95
State & Autonomous	138,500	302,603	509,563	518,513	274.38
Private	76,917	142,764	261,483	320,000	316.03
Total	279 495	607 951	1 057 744	1 255 626	349.25
Middle Terminal (Tech.)					
Federal	9 399	15 547	32 473	221 929	2 261.20
State-autonomous	11 315	28 726	38 467	49 727	339.48
Private	13 147	34 109	51 451	72 474	451.26
Total	33 861	78 382	122 391	344 130	913.30
Normal					
Federal	15 938	28 430	54 922	51 152	220.94
State-autonomous	16 603	35 116	55 172	60 456	264.13
Private	23 402	47 956	98 003	78 572	235.75
Total	55 943	111 502	207 997	190 180	239.95
Total	369,299	797,835	1,388,132	1,789,936	384.69
% of enrolment, by Specialization**					
Baccalaureate		79.9	72.4	71.4	
Middle terminal		10.2	9.5	21.0	
Normal		10.3	7.1	5.3	

* 1975-82 only

** As compared to the total of secondary-school graduates in the previous school year.

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Table 11: Higher education: total enrolment (including post-graduate), by type,

Type of control	1972/73	1975/76	1980/81	1982/83	Percentage of growth
Total higher education	355 226	543 112	935 789	1 074 601	202.51
- New enrolment 1st year	112 219	166 666	242 814	282 708	151.93
Schools	138	196	272	293	112.32
Graduates	33 373	52 866	82 886	95 690	186.73
UNAM*	87 434	127 600	131 232	149 800	71.35
- New enrolment 1st year	23 635	32 480	27 980	31 939	35.13
- Graduates	7 738	14 145	11 322	12 900	66.71
UAM**		5 531	23 009	33 659	508.55
- New enrolment		3 866	4 725	6 747	74.52
- Graduates		-	308	450	-
State universities and institutes	122 174	200 143	439 352	486 233	297.93
- New enrolment	39 559	67 876	111 082	124 529	214.79
- Graduates 12 098	12 098	18 604	36 329	42 590	252.04
Private and free	48 875	78 200	106 510	148 166	203.15
- New enrolment	17 981	24 802	30 670	39 344	118.81
- Graduates	2 657	6 916	10 206	13 647	413.62
National Polytechnical Institute	57 196	68 672	55 734	53 600	-6.29
- New enrolment	18 859	16 821	15 481	14 721	-21.94
- Graduates	5 952	8 712	6 686	6 358	6.82
Upper normal	27 721	41 139	123 710	127 271	359.11
- New enrolment	7 140	12 103	34 995	42 306	492.52
- Graduates	3 883	2 223	12 665	11 935	207.37
Specialized normal	386	723	798	799	106.99
- New enrolment	233	426	250	255	9.44
- Graduates	69	195	350	373	440.58
Federal institutions	11 440	21 194	55 444	75 673	561.48
- New enrolment	4 812	8 272	17 631	22 867	375.21
- Graduates	936	2 071	5 030	7 413	691.99

* Universidad Nacional Autonoma de Mexico.
** Universidad Autonoma Metropolitana, began operating in 1974.
Source: VI Presidential Report.

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Table 12: Enrolment of 20-24-year-olds in institutes of higher education

		1959/60	1970/71	1974/75	1980/81
I Northwest					
Baja California,	Enrolled	1 003	10 857	27 483	90 936
Chihuanua,	General population	285 400	414 900	521 020	626 626
Sinaloa	% participation	.35	2.62	5.27	14.51
II North					
Nuevo Leon,	Enrolled	7 144	28 267	55 156	113 925
Coahuila,	General population	263 000	380 900	436 900	558 674
Tamaulipas	% participation	2.72	7.42	12.62	20.39
III Central					
Aguascalientes,	Enrolled	1 159	8 009	15 801	36 470
Durango, Quer.	General population	265 400	306 900	352 600	449 779
S.L.P. Zacat.	% participation	.43	2.61	4.48	8.11
IV West					
Colima, Guanaj.	Enrolled	6 274	35 695	62 481	122 138
Jalisco, Nay.	General population	512 000	703 000	846 400	1 010 655
(Michoacan	% participation	1.22	5.08	7.38	12.09
V South-Central					
Guerrero, Mex.	Enrolled	3 577	20 664	38 029	104 272
Hidalgo, Mor.	General population	526 600	813 400	984 910	1 400 941
Puebla, Tlaxcala	% participation	.69	2.54	3.87	7.44
VI South					
Chiapas, Tabs	Enrolled	2 090	13 168	16 238	81 039
Veracruz,	General populatiopn	528 600	694 400	806 600	953 004
Oaxaca	% participation	.39	1.96	2.01	8.50
VII South East					
Campeche	Enrolled	621	2 024	5 852	10 266
Yucatan	General population	66 800	95 400	115 970	132 681
Q. Roo	% participation	.93	2.12	5.01	7.74
VIII Mexico City	Enrolled	48 860	137 202	220 668	226 373
	General population	436 200	698 400	810 600	1 051 239
	5 participation	11.20	19.65	27.22	21.53
National total	Enrolled	70 728	225 886	441 708	785 419
	General population	2 884 100	4 100 700	4 875 000	6 183 602
	% participation	2.45	6.24	9.06	12.70

Source: Castrejon Diez J. 1976.
* SEP: Plan Nacional de Educacion Superior (does not include Upper Normal or Post-graduate).

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Table 13 - Terminal efficiency in higher education

Cohort	% graduating
1967-1971	58.2
1968-1972	51.4
1969-1973	51.6
1970-1974	49.1
1971-1975	48.1
1972-1976	45.9
1973-1977	46.5
1974-1978	39.7

Source: SEP, Direccion General de Coordinacion Educativa. Quoted by Castrejon Diez J., op.cit.

Over the past decade, enrolment in higher education has grown in absolute numbers in all the specializations. The coordinating efforts of ANUIES, however, have not managed to correct some of the problems detected in the 1960s related to heavy enrolment in medical sciences, social sciences and administration. The tendencies indicated a decrease in the relative weight of the natural and the exact sciences (from 7.54% of the total enrolment in 1972 to 5.82% in 1982) and of engineering and technology (from 31.14% in 1972 to 27.4% in 1982). The agricultural sciences have grown significantly (from 3.58 to 7.27%) while medical sciences increased by almost 2% (from 19.18 to 20.99%). Social and administrative sciences have remained stable, absorbing 37.4% of the total enrolment (Table 14).

Table 14 - Enrolment in higher education, 'licenciatura' and post-graduate, by the area of study

Areas	1972-73	1975-76	1980-81	1982-83
- Natural and exact sciences	24 668	36 639	47 177	55 042
- Medical sciences	62 726	95 463	170 311	198 703
- Agricultural sciences	11 726	22 010	58 993	68 828
- Engineering and technology	101 858	153 837	222 943	260 110
- Social and administrative sciences	122 607	188 072	308 148	353 687
- Education and the humanities	3 534	5 229	8 709	10 161
TOTAL	327 119	501 250	816 281	946 531

These tendencies are even more exaggerated when the number of graduates is taken into account, since the medical sciences have greater rates of efficiency, respresenting in 1980 25.8% of a total of 69,920 graduates, administrative and social sciences 35.8%, and engineering and technology 25.3%. The natural and the exact sciences produced only 2.3% of the total graduates.

Post-graduate studies: Relatively new in Mexico, enrolment in Masters studies for the academic year 1975-1976 was 7,500, and only 232 in doctoral studies in the entire country. The great majority of the studies were in the social and administrative sciences (53.09% of the Masters and 50.0% of the doctoral); in physics only 2.78% studied for the Masters and only 14 students for the Ph.D. The situation in chemistry and mathematics was even worse - 1.97% of the Masters students in each, 6 students in doctoral studies in chemistry and 11 in mathematics - 2.45% of the Masters candidates and 49 Ph.D. candidates were in the biological sciences.

Since 1979 there have been substantial increases. We do not have disaggregated data for Masters, Ph.D. or Specialized studies; the figures for the total post-graduate enrolment show 24,313 students in 1979, the majority of them (60.7%) in universities and institutes in the Federal District. In 1980 there were 30,627 students, with an even higher rate of concentration in the Federal District (64.1%). The number of institutions that offered Masters of doctoral studies grew rapidly, especially on the Masters level - from 76 institutions in 1979 to 114 in 1981. The Ph.D. was offered by 10 institutions in 1979, by 14 in 1981. Growth is still concentrated, since 65% of the enrolment is in the Federal District. The rest of the enrolment by zones is distributed in the following way for the 1980-1981 academic year: NW: 3.63%; N: 15.44%; C: 1.49%; W: 7.81%; SC: 5.01%; S: 1.67%; SE: 0.88%.

3. Qualitative Aspects

The rapid growth in enrolment at all levels of the formal and informal educational system is in general satisfying many expectations, and undoubtedly fulfilling a range of social, economoic and cultural needs. But, there are serious qualitative problems - some due to the effect of this growth on the school system, and the improvisations that had to be made, others to difficulties in planning and programming, to the autonomy of an educational system that continues to function according to patterns that correspond to out worn needs, and still others to unconsciousness of the complexity of the processes involved and the lack of appropriate knowledge on the part of educational specialists. Some of these problems have been discussed in Chapter 1.

In general, the attempts to introduce some degree of rationality in the development of educational systems continue on assumptions that the specialized literature has strongly criticized; models have been accused of being simplistic, linear, or simply not taking into account important aspects of reality. The plans and programmes in operation in recent years seem to have concentrated on the quantitative aspects of the demand, especially the problems of supply. Only marginally have they faced the problems of knowing students in the system, or the quality of education on all levels, although many studies and declarations of principles have been formulated on these subjects.

Thus the situation in Mexico seems often to be characterized by the following problems:

1. although growth in enrolment is notable in relative terms, the absolute numbers in the population that remain marginal to the system are considerable (we have already seen that there are still 22 million people that have not completed primary school, among whom more than 6 million are illiterate);
2. the problems of access to the primary level are usually related to the rural population (although the educational supply has increased, rural dwellers still average between 1 and 3 years of schooling, generally in single-classroom schools with poorly qualified teachers and very poor material resources. Dropping out, absenteeism (sometimes more acute amongst the teachers than the students), late entry into the school system, coexistence of groups of widely divaricate ages, failure, etc. are critical and unresolved problems;
3. in urban areas the supply of primary schooling is complete and the rates of school attendance high (there are still serious problems of achievement and quality of education, especially that given to children of less privileged groups, who are the majority. The upper-middle and upper classes send their children to private schools, where the attention they receive is generally better quality than that of the public schools. There has been a greater tendency to send children into the formal system at earlier ages (pre-school) in recent years, resulting in wide social differences in the quality of learning at the outset of elementary school);
4. patterns of enrolment, when analysed by cycle or level, indicate that growth in the middle and upper levels is often much faster than in the primary level (although

this situation has improved in recent years there remain situations of high illiteracy rates and low rates of primary schooling coexist with high rates of middle- and upper-level attendance);

5. rates of academic achievement vary with social class (the higher the social class of the student, the greater his chances of success);
6. the probability of failure is higher in the lowest grades of each cycle or level, and the proportion of students finishing one level who go on to the next is very high (the processes of social discrimination are then not so acute between cycles or levels as within each level);
7. in the middle level of the system more sophisticated but no less effective forms of social discrimination begin to appear (the existing differentiation between modalities, general secondary, baccalauréat, technical, normal - and between terminal and non-terminal, apparently, and in fact, regulate flows that reproduce the social system in the educational supply. One-, two-, and three-year programmes prepare skilled workers, middle-level technicians, and baccalauréates of the middle and upper classes destined for elite training and university entrance);
8. higher education follows branch structures similar to those of the middle level, with distinctions between short and long professional and semi-professional career training (universities are full or part time, open, by correspondence, etc.). When higher education reaches the masses, the dropout rates increase and the quality of the graduates decreases. Attempts at coordination have generally met with little success, since university autonomy discourages the introduction of patterns of rationality on a national scale;
9. from the economic perspective, investments in the production of capital and human resources, do not seem to produce the desired effects (results are sometimes the opposite of those expected. It is the middle and upper classes that, by staying a longer time in the system, are most subsidized with public funds);
10. the effects of internal migration on education seem significant. (There is a relationship between migration and formal education - the best educated emigrate, and are in turn less well educated than are students in the receiving community. There is thus a net reduction in the educational achievement rate in the areas of emission and those of reception. In the case we are examining in this study, combined effects are produced,

but what is interesting to point out here is that when a country is subjected - as is Mexico - to intense internal migration, attempts to improve rural education, to make it more pragmatic and appropriate to the specific needs of the environment, can be thwarted by the fact that many of the children concerned will eventually end up living in other environments);

11. through international migration, the most dramatic transformation into a loss is the 'brain drain', the transference of human capital from an underdeveloped to a developed country (this migration has a quantitative and qualitative character: the first is expressed in the volume of professionals and technicians that emigrate, the second in the type of technicians and professionals exported. Although Mexico has generally been a 'receiver' of technicians and professionals and a 'sender' of less qualified personnel, the generalized economic crisis will tend to reverse the situation);
12. from a regional point of view, structural tendencies may aggravate the inequalities, leading to relative concentration of educational opportunity in the more advanced regions, and especially widening differences in the quality of education received (the situation is especially critical to those whose occupational opportunities and incomes depend on the type of schooling received, especially on the global level);
13. regional inequalities observed in terms of educational supply reflected in enrolment at various levels in the system are also reflected in quality of education and the supply of both skilled and unskilled manpower);
14. educational processes occur within schools and within specific classrooms, and there is an enormous distance between what should supposedly be done, what people say is done, and what is actually done (one of the weakest links in the whole educational process is found precisely here, and this is what most affects the quality of the education received. Pedagogy, educational psychology and the other specializations through which theoretical principles can be effectively applied to specific educational processes constitute a very new experience, and much remains to be done in these fields, not only in Mexico but in the rest of the world. The normal modalities for preparing teachers for the pre-primary, primary and middle levels are highly vulnerable to political interests, and graduates go out into the field with low levels of professionalism. On the level of higher education, problems are the product of specific interests of a political nature,

massification of the universities through rapid growth of enrolment, and thus the use of inexperienced professors);

15. on the research level, as stated above, experiences are also rather new, and more a part of very specific focuses than of generalized practice (there have been important experiments, but they do not manage to cover the minimum necessary to promote a style and a set of dynamics);

16. finally, on the level of educational planning, albeit inclined to a great extent to operate under assumptions and models that favour the quantitative over the qualitative, considerable fruits have been yielded, particularly related to the need for transforming the educational system (the success of plans and programmes - which in Mexico are very advanced - varies not only with their technical quality, but usually with political convenience, degree of preparation of personnel, rejection or acceptance by the people concerned, etc.). In Mexico, political convenience is dominant; plans and administration are determied by it. Gaps between political decisions and their implementation occur in part because state planning agencies have not been capable of mobilizing on all levels of the political system, the public feeling that there are situations that require solutions. Perhaps because the implementation of planning appears to be overly dependent on complex mathematical models that seem far from the reach of politicians and laymen, but also because plans depend too much on quantitative factors, their dimensions, are often at a variance with the assumptions of the model, particularly their qualitative dimensions. Such is the typical case not only of 'imported' models but of those that ignore the perceptions of the social agents toward whom the plans are directed.

4. Education in the technological system

i) Historical evolution

In the 16th and 17th centuries, missionaries such as Pedro de Gante, Juan de Zumarraga and Vasco de Quiroga taught the indigenous and marginally urban populations domestic animal husbandry and the industrialization of agricultural products. But it was not until the 19th century that schools which awarded diplomas were formed:

- in 1845 the School of Commerce and Administration was formed (and still exists);
- in 1856, the School of Arts and Crafts;
- in 1916 the National School of Arts and Crafts (for the elementary training of manpower) was transformed into the practical school of Mechanical and Electrical Engineers;
- in 1922 the Technical School of Construction Masters;
- in 1923 the Technical-Industrial School;
- in 1925 the Central Agricultural School for the education and training of farmers;
- in 1932, with the rise of socialist education in Mexico:
  - the Central Agricultural School was transformed into a Regional Farming School for agriculture, cattle breeding, rural industries and teacher training,
  - the four-year Technical High Schools were created, awarding diplomas as technicians in various specializations;
- in 1937 the National Polytechnical Institute (IPN) was created, going from prep school (upper cycle of middle level) to professional and post-graduate (studies begin in two-year prevocational schools as preparation for the two-year vocational schools, which are divided into two types: Economic and Social Sciences, and Biological and Chemical Sciences. These in turn prepare the student to go on to the professional schools, which give the following degrees: engineering (mechanical, electrical, construction, sanitary, road, hydraulic), textiles technology, public accounting, actuarial auditing/accounting, economics, statistics, business management, mercantile technology, medicine (homeopathic, surgery, midwifery, nursing), chemistry (bacteriology, parasitology), zimological chemistry, (chemical engineering). (The institution arose from a pragmatic concept of education for industry, with a clear and immediate utility. For the students it "represents the possibility of having a useful, solid lucrative career, within no more than 8 years of completing primary school. See Mexico, 1973b);
- in 1941 the Regional 'Campesino' Schools were divided into two types: Normal Schools for preparing rural teachers, and terminal Practical Agricultural Schools for elementary technology;

- in 1958 the Sub-secretariat of Technical and Upper Teaching was created, formally introducing the concept of technical secondary teaching;
- in 1967 the Agricultural Technical Schools were started (by 1969 there were 34 of these throughout Mexico. The 13 rural Normal Schools were changed to these, and to the National School for Teachers in Agricultural Job-Training Schools);
- in 1970, the Sub-secretariat of Higher Technical Education was changed to the Sub-secretariat of Middle, Technical, and Higher Education, with departments of Physical, Secondary, Industrial/ Technological, Agricultural/Technological, Marine Sciences and Technology; Higher Education and the National Polytechnical Institute;
- in 1975 a law was passed creating the Council of National System of Technical Education, with the aim of coordinating and unifying the activities of the offical institutions of technical education on the upper-middle and upper levels;
- in 1978, in line with SEP directives, CONALEP (1) set about preparing the qualified professional personnel on the post-secondary (upper-middle) level required by the national production system. Studies are terminal; the uniqueness of the system is in the relationships between CONALEP and the production sector, through which CONALEP agrees to train workers skilled in the specializations required by the companies. The companies, for their part, agree to provide the facilities and to give funds for the construction of school buildings, furnishings, and basic equipment. The Commissions established within CONALEP and the private companies have as their functions to authorize plans and programmes of study; to design and execute courses and programmes of continuing education; to select teaching personnel; to set the terms, modalities, and conditions in which specific courses required by other companies can be established. The agreements also specify that is not the obligation of the company to hire the graduates, but only to give them the possibility of being selected and hired according to the interests and needs of the company.

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(1) The National College of Professional Technical Education, a decentralized organism of the federal government.

ii) The evolution of enrolment (1)

Complete and detailed information on enrolment is available for only 1970 and 1978; there are some data for 1982-1983.

Skill training studies: For the 1970-1971 school year twenty-seven Centers for Industrial Technological Training (CECATI) were in operation, and there were courses in other establishments. All come under the National System for Technological Education, and the training courses vary in duration from 20 to 40 weeks. In the 1970-1971 period, 21,811 students were trained. For the 1978-1979 period, two new schools were added, as well as four Training Centres for Agricultural Work; 27,067 persons were trained in that year. The growth rate of the training system for the 1970-1976 period was 24.1%, much lower than those of the other levels of the technological system (see Table A.2.2 in the Appendix). Of course other training organisms exist, as we will see in other sections of this report. During the 1978-1979 school year, 224,382 workers were being trained throughout the school system; this figure increased to 431,473 in 1981-1982 (a growth rate of 76.56% over the period 1976-1982).

Lower-middle level: From 189 schools in the whole country, with 85,000 students enrolled in 1970, there was an increase to 1,032 schools by 1978, with 446,966 students; 1970-1978 was a period of intense growth in general secondary schools (11% annually), but the growth in technological schools was indeed impressive, 20.1% annually. In 1970, 92.3% of the total enrolment in secondary education was in the bachillerato programme, whereas by 1978, 29.4% of the enrolment in this level was in the technological schools. The technological schools with the fastest rate of growth were the agricultural schools, which grew from 87 to 734 between 1970 and 1978, with a growth in enrolment from 17,000 to 193,000 students. Since 1975, when the technological fishing schools were created, enrolment in these schools has grown by around 25% annually. Enrolment in the industrial technology schools grew rapidly, but the enormous expansion of the other technology modalities kept its proportion down. From 84% of the total in 1970 it dropped to 55% in 1978, while agricultural enrolment grew from 16 to 43% of the total enrolment in this level.

Upper-middle level: Although not as spectacular as that of the basic level for the period 1970-1980, the growth rate of this level of the national technological system was considerable, 242.3%, or an annual rate of 16%. The industrial

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(1) See Tables A.2.1-5 in the Appendix to Chapter 2.

Table 15: Basic statistics for the national technological system of education (1978-79) enrolment by educational level and type

	Schools		Training centres	Lower Middle	Upper Middle	Upper middle terminal	University	Total
	Type(1)	Number						
Secondary Technological	CeCaTi	29	16 568					16 568
	CeCaTa	4	1 145					1 143
	F Tecnolog		9 345					9 345
	Agro.	734		192 998				192 998
	Ind.	266		246 665				246 665
	Fish			7 303				7 303
	Subtotal	1 065	27 067	446 966				474 033
Industrial Technological Schools	CET	39				14 877		14 877
	CECvT	119			60 366	2 689		63 055
	ENaMaCTI	1				2 004		2 004
	Subtotal	159			60 366	19 570		79 936
Farming Technological	CETA	101			35 367			35 367
	CETF	6			1 219			1 219
	ENaMaCTA	1				505		505
	ITA	17				1 901	1 098	2 999
	ITF	1				89		89
	Subtotal	126			36 586	2 493	1 098	40 179
Marine Sciences	CECITEM	7			2 526			2 526
	IESCITEM	1					373	373
	Subtotal	8			2 526		373	2 899
National Polytechnic Institute	CECvT	15			71 861			71 861
	ESC.SUP	14					77 067	77 067
	Subtotal	29			71 861		77 067	148 928
Centres	CENETI	1					1 269	1 269
	CERETI	2			1 051		298	1 349
	Subtotal	3			1 051		1 567	2 618
Technological Institutes	ITR	48			38 505		29 563	68 063
	Subtotal	48			38 505		29 563	68 063
Totals		1 438	27 067	446 966	210 895	22 065	109 668	816 661

(1) Types

CeCaTi: Centres for technological-industrial training.
CeCaTa: Centres for farming-technological training.
F Tecnolog: Centres for forest-technological training
Agro.: Secondary technological farming.
Ind.: Secondary technological industry.
Fish.: Secondary technological fishing.
CET: Centres for technological studies
CECvT: Centres for scientific and technological studies.
EnamaCTI: National schools for technological-industrial teacher training
CETA: Centres for technological farm studies.
CETF: Centres for technological forestry studies.
ENaMaCTA: National schools for teachers technological farming.
ITA: Technological farming institutes.
ITF: Technological forest institutes.

CECITEM: Centres for teaching of marine sciences.
IESCITEM: Institutes for advanced studies in science and technology of the sea.
CECvT: Centres for scientific and technological studies.
ESC.SUP.: Schools of the I.P.N.
CENETI: National centres for technological industrial teaching
CERETI: Regional centres for technological/industrial teaching.
ITR: Regional technological institutes.

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branch absorbed the greatest volume, 82% of enrolment and 66% of the schools, but it was the agricultural sector that grew most dramatically, from 2 schools in 1970 to 107 in 1978, and an annual growth in enrolment of 96%. The schools of Marine Science and Technology, of which there were five, and in which there were 783 students in 1975, had 7 schools and 2,526 students in 1978. In 1970, 22 out of every 100 students in the uppermiddle level were in technological branches; by 1978 the figure had grown to 30. Since 1978 concern has been concentrated on the problems of the terminal levels of the system: until 1978 enrolment in the terminal system was only 8.3% of the total enrolment. Beween 1976 and 1982, basically because of CONALEP and other federal government actions, it began to grow; it went from 81,000 students in the 1976-1977 school year to 344,000 in 1982-1983, when the middle terminal system absorbed, and comparing it only to the bachillerato, 21.51% of the students.

The National College of Professional Technical Education (CONALEP) is offered as another alternative; to begin with, it offers technical-professional degrees for 3-year programmes following the basic middle level. Studies are terminal. Enrolment in the system was 6,736 students in 1979, 19,290 in 1980, and 57,542 in 1981, and about 90,000 in 1982. Throughout the country more than 70 specializations of 5 to 7 semesters are possible. In the state of Michoacan, where 9 CONALEP schools operated, the following technical-professional degrees were offered in 1982 (1):

- Administrative
  - Accounting (fiscal).
  - Accounting (industrial).
- Agriculture and livestock
  - Agro-industrial business administration.
  - Conservation of farm products (fruit and vegetables).
  - Farm machinery.
  - Stock breeding.
- Construction
  - Heavy construction.
  - Urban construction.
- Industrial
  - Mechanical electronic maintenance.
  - Productivity.
  - Mechanical manufacturing.

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(1) In other areas, health studies are offered as well.

- Maritime
  - Port administration.
- Fishing
  - Aquatic production.
- Tourism
  - Hotels and restaurants.
- Steel
  - Metal manufacturing.
  - Steel forging and moulding.
  - Soldering.

Among the technological systems, one of the most noteworthy aspects of CONALEP is the broad publicity and promotion campaign that is undertaken; the modality is 'sold' with the same marketing criteria used in selling cars or soap. In the analysis of the Conurbation Zone we shall point out characteristics of the CONALEP schools operating in Lazaro Cardenas and in Zihuatanejo.

Technological university level: With an enrolment growth of 143% between 1970 and 1978, this level has nonetheless been the slowest growing in the formal technological system. Its annual growth rate was 10.8%, as compared with the university level in general which grew at a rate of 12.7%. Its share in the total university enrolment was 16.6% in 1970, 17.9% in 1978.

The system of higher education in technology is made up of the National Polytechnical Institute (which offers, in addition to the graduate level offered in its 14 centers, 37 Masters programmes and 10 doctoral programmes in 10 postgraduate centres); of 48 Regional Technological Institutes; 17 Agricultural Technology Institutes; 1 Institute for the Exploitation of Marine Resources.

The National Polytechnical Institute doubled its enrolment between 1970 and 1978, with an annual growth rate of 7.5%. Its enrolment for 1978 was 77,000 which represents 70.5% of the enrolment of the technological institutes altogether. However, as we saw earlier in the general section, the growth rate of the Polytechnical Institute changed, its total enrolment in licenciatura for 1980-1981 being 53,000. Without considering the general programmes that are given in the first trimesters of the career, the IPN enrolment distribution by specialization was as shown in Table 18:

Table 16 - Growth of the technological system, 1970-1978

Educational Level		1970-71		1978-79		1970-78
		Schools	Students	Schools	Students	%
SKILL TRAINING	CeCaTI	27	13 001	29	16 568	24.1
	CeCaTa	-	-	4	1 145	
	Tech.F.	-	8 810	-	9 354	
LOWER MIDDLE	Agric.	87	16 816	734	192 998	426.8
	Ind.	102	68 036	266	246 665	
	Fish.	-	-	32	7 303	
UPPER MIDDLE	CECyT	10	6 297	119	63 005	242.3
	CETA	2	168	101	35 367	
	CETF	-	-	6	1 219	
	CECITEM	-	-	7	2 526	
	IPN	12	40 643	15	71 861	
	CERETI	1	773	2	1 051	
	ITR	-	14 520	-	38 505	
UPPER MIDDLE (TERMINAL)	CET	8	?	39	14 877	1 376.8
	ENaMaCTI	1	671	1	2 004	
	ENaMaCTa	1	641	1	505	
	ITA	-	-	-	1 901	
	ITF	-	-	-	89	
UPPER OR UNIVERSITY LEVEL	ITA	-	-	17	1 098	142.6
	ITF	14	5 781	48	29 560	
	IPN	10	38 656	14	77 067	
	CENETI	1	614	1	1 269	
	CERETI	-	-	-	298	

Table 17 - Estimate of technological enrolment growth by education level (number of students)

Level	1980	1982	1984	1990
SKILL TRAINING	43 000	52 000	63 000	150 000
LOWER MIDDLE	528 000	625 000	730 000	1 100 000
Industrial	289 000	325 000	362 000	534 000
Agricultural	230 000	288 000	352 000	534 000
Fishing	9 000	12 000	16 000	33 000
UPPER MIDDLE (TERMINAL)	64 100	130 000	186 200	290 000
UPPER MIDDLE	262 200	312 000	359 600	520 000
UNIVERSITY	140 200	188 500	240 400	390 000
POSTGRADUATE	5 000	6 000	7 500	15 000
TOTAL	1 042 400	1 313 500	1 586 700	2 465 000

Table 18 - IPN enrolment (1980-1981)

	%	(Estimated enrolment)
Architecture	14.5	(9 867)
Public accounting	13.0	(8 848)
Medicine	8.2	(5 559)
Industrial chemistry	6.5	(4 420)
Communications and electronics	6.5	(4 399)
Economics	5.9	(4 007)
Indust. admin.	5.7	(3 862)
Commercial relat.	5.4	(3 662)
Mechanical eng.	5.1	(3 439)
Indus. engineering	4.9	(3 321)
Civil Engineering	4.7	(3 191)
Elec. engineering	2.9	(1 890)
Tourism	1.8	(1 233)
Inform. Sciences	1.5	(1 024)
Physics, math.	1.5	(1 002)
Chem. bacteriology	1.0	(707)
Geology	0.7	(480)
Biochemistry	0.6	(414)
Aeronaut. engineering	0.6	(403)
Metallurgical engineering	0.5	(315)
Optometry	0.4	(260)
Indust. Pharm. Chem.	0.3	(222)
Biology	0.3	(220)
Textiles engineering	0.2	(149)
Dentistry	0.2	(140)
Transport engineering	0.2	(116)
Photo topography	0.2	(109)
Textiles	0.2	(105)
Nutrition	0.1	(99)
Geophysics	0.1	(93)
Petroleum engineering	0.1	(93)
Knitted textiles	0.1	(55)
Social work	0.0	(22)
Nursing	0.0	(8)

As can be clearly observed, the composition of the student body by career is very similar to that of the conventional universities, engineering making up only 19.2% of the enrolment, economics, accounting and commercial relations adding up to 24.3%.

The careers offered by the Regional Technological Institutes follows a different pattern of careers traditionally offered in the universities (medicine, architecture, accounting, economics); there is greater concentration in the technological careers, but still a good deal in those careers related to administration. The distribution of the enrolment of 29,563 students is shown in Table 19:

Table 19 - Enrolment in regional technological institutes, 1979

Techn. commun., ind. eng.	15.5%	(4 570)
Industrial production	10.8	(3 194)
Business administration	10.4	(3 080)
Industrial electricity	8.4	(2 469)
Industrial chemistry	6.8	(2 001)
Industrial thermal mechanics	6.2	(1 841)
Industrial electronics	5.4	(1 584)
Industrial mechanics, manuf. design	5.1	(1 503)
Food biochemistry	2.7	(795)
Civil engineering, Telecommunications	2.6	(768)
Public accounting	2.5	(743)
Civil eng. in community development	2.1	(611)
Civil eng. in hydraulic works	1.8	(519)
Electrical engineering	1.6	(470)
Chemical engineering	1.6	(470)
Electromech. engineering	1.6	(460)
Electromagnetic telecom. eng.	1.4	(425)
Elect. palm. mat.	1.4	(417)
Telecom c. admin.	1.1	(333)
Industrial relations	1.1	(321)
Structural civil engineering	1.0	(281)
Mechanical engineering	0.9	(274)
Electrom. eng. in production	0.8	(240)
Industrial electr. eng.	0.8	(233)
Biochm. of natural products	0.7	(217)
Commercial relations	0.7	(216)
Electromech. design	0.6	(192)
Architecture	0.6	(185)
Industrial engineering	0.6	(169)
Metallurgical engineering	0.6	(163)

Table 19 (contd.)

Civil eng., roads and highways	0.5	(147)
Civil engineering	0.4	(116)
Admin. in tourism	0.3	(74)
Steel engineering	0.2	(66)
Geophysics, mining	0.2	(53)
Petro. geology	0.2	(52)
Geohydrology	0.2	(51)
Planning engineer	0.2	(51)
Civil eng., soil mechanics	0.1	(41)
Information sciences	0.1	(24)
Elect. administration	0.0	(13)

This tendency toward early specialization in the Regional Technological Institutes contrasts with the general diplomas given out by the CENETIs (1) and the CERETIs, the Agricultural Technological Institutes and the Higher Institutes of Marine Sciences and Technology.

Table 20 - General technological diplomas

CENETI and CERETI		
Industrial engineering	75.3%	(1 069)
Civil engineering	24.75%	(350)
Agricultural Technological Institutes		
Eng. coop. admin.	14.2%	(156)
Eng. in rural development	85.8%	(942)
Institute of Higher Studies in Marine Science and Technology		
Licenciatura in:		
Fishing bus. admin.	33.5%	(125)
Agriculture	25.2%	(94)
Fishing methods	21.7%	(81)
Food production	19.6%	(73)

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(1) Three of the CENETI's were closed by the SEP in 1983.

iii) Qualitative Aspects

In 1978 the Secretariat of Public Education pointed out among other things the persistence of serious problems that affected the quality and efficiency of the educational services provided by the technological system. It was noted that the capacitation and training offered on the post-primary level constituted a body isolated from the rest of the educative services, uncoordinated with other types of job-training studies or with the basic studies for the adult population. The disfunctionality of the middle levels - and especially the upper-middle - particularly regarding the incorporation of graduates into the labour market, was of great concern to the SEP. It had then been observed that 85% of the graduates in industrial specializations enrolled in higher-level studies, and there were important problems here: while the National Polytechnical Institute automatically accepted into higher studies its own graduates from the upper middle level, the Regional Technological Institutes required entrance exams, whatever the type of bachillerato completed. In the agricultural and fishing schools, only candidates from within the same school were admitted and they were required to take entrance exams.

The annual growth rate of enrolment in all levels, although spectacular, did not manage to satisfy the expectation for change in some levels of the system. This was especially true on the upper levels, where in spite of an annual growth rate in the technological sector of 10.8%, the proportion of technological enrolment in the total enrolment had declined from 19% in 1970 to 17% in 1978.

The open systems introduced in 1974 into the Polytechnical Institute had an enrolment of 6,500 students in 1978 (upper and middle); those introduced in 1977 into the Regional Technological Institutes had 3,500 (upper only).

With respect to achievement in the system, the available information is confusing and unreliable. Terminal efficiency in the 1971-1972 and 1973-1974 school years was 62.1%; for 1975-1976 and 1977-1978, it grew to 73.2%. It was seen that the least efficient were the fishing technology schools (65.6%), and the most efficient were the agricultural (77.3%). Terminal efficiency calculated for the industrial schools was 70.6%. On the bachillerato level, the problems were even more serious:

Fishing	52.9%
Industrial	50.5%
Agricultural	72.7%.

Post-graduate programmes were restricted to the 12 centers of the IPN, and to 9 centres of the Regional

Technological Institutes. Scientific and technological investigation was developed in very few institutions. According to the diagnosis of the SEP, even when around 50 applied research projects were developed, only a minute portion of them had realistic chances of having their products introduced. Research is concentrated in the IPN and in its Centre for Advanced Study and Research (80%), thus in the Federal District, and it is frequently "unrelated to the production sectors and to the problems of a developing country" (SEP, 1973).

Social service is a mere bureaucratic procedure; there are no well-defined plans, and coordination with private and government organizations is minimal. Even in organizations such as CONALEP, where the relationship with the companies is closer, social service donated by the graduates of the technical schools takes the form of cleaning and routine tasks, which have little to do with coordination, control, etc.

Technological education continues to a great extent to be associated with 'vocational' education, and so drags along from the past the tradition of the arts and crafts schools for the socially marginal. Historical tendencies in more developed countries are towards an increase in vocationalism or the early formation of specialists, but in Mexico vocationalism is still too closely tied to the structures and flow systems of each social group. The growing demand for education is then made concomitant with rationalization loaded with ideology about the requirements of the labour market, in a scheme of middle-upper and upper instruction that channels demand according to class structure, in which education as culture is reserved for the sectors of the population with sufficient pressure capacity and resources to obtain it, education as technology for the children of peasants and labourers.

To the criticism levelled at the whole middle and upper educational system - that it is of poor quality, that the emphasis is too much on books and that students graduate with little knowledge or practical skills, and that the tendencies are towards too much enrolment in the upper levels of the system - an answer was sought through bureaucratic artifice and manipulation of the educational supply.

In the conurbation, this type of schooling is somewhat different from that in the rest of the country; in the corresponding section we will discuss its specific characteristics. On the level of the country as a whole, however, it continues to be pointed out that the vocational type of education (agricultural, industrial, and commercial) is not perceived as a channel of upward social mobility, especially when the authorities themselves insist on reforms that will result in more terminal programmes in the system.

The conventional or general bachillerato programmes continue to be perceived, and with greater reason in the less developed regions of the country, as more desirable, since they allow access to the cultures of the high-status groups.

Thus there is a good deal of sense to the characterization of education as a mechanism for entrenching a status in which the main function of the school is reinforcement of special cultures within and outside the classroom. The school teaches vocabulary and inflections, dress styles, tastes, values and manners; it is not really important that it fails to impart technical skills. One of the most noteworthy characteristics in Mexican technological education on the middle and upper middle levels lies in the patterns of socialization that are perceived to be functional to behaviour expectations in technicians - insistence on values that make a 'good worker', the vertical relations between superior and inferior, learning 'from the bottom up' - in short in a whole system of indoctrination that corresponds to the expectations of employers, and conflicts with another set of 'cultural', 'humanistic', 'respectability' expectations.

It is possible that on this level changes in the curriculum and nomenclature of careers, above all the titles awarded by the CONALEP, effectively provide an advantage for the technical professionals over the general bachilleratos upon entrance into the labour market, especially in situations like that of Lazaro Cardenas where titles are closely related to the very specific demand of the growing labour market. But in the medium term, the terminal nature of the modality, and its emphasis on the pragmatic, can create important difficulties both in the sub-system and for its graduates.

Section II: THE CONURBATION OF THE LOWER BALSAS RIVER

Introduction

The extraordinary growth of the Mexican economy over the past 30 years (an average of 6% of the Gross Natioal Product annually in real terms) has been accompanied by a concentration of industrial production in the three principal federal areas - the Federal District and the states of Mexico and Nuevo Leon - which in 1980 contributed 63% of the gross value of industrial production of the country.

This imbalance is aggravated by problems of population agglomeration, large-scale waste, environmental contamination, preferences for internal markets, dependency on foreign capital, sluggish employment generation, concentration of income, widening inequalities, all shaping what some experts define as 'the crisis of the import substitution' model. Regional development strategies are aimed at correcting these structural defects. The Conurbation of the Lower Balsas River is a spatially limited, regionally defined planning area, embracing the 5 countries in the States of Guerrero (Coahuayutla, José Azueta, La Union) and Michoacan (Arteaga and Lazaro Cardenas) on the Pacific Coast of Mexico. The total area covers 11,600 square kilometers, and supported, in 1980, approximately 200,000 inhabitants. In the economic policy of the Mexican State, this zone constitutes a "development center", designated as an agent to intensify the process of capital accumulation through the creation of large industrial complexes oriented towards both foreign and national markets. It is hoped that the overall impact of the general increment in production and productivity, and the redistribution of a growing population therefore concentrated in Mexico City, Monterrey and Guadalajara, will combine to advance the general development of the nation.

But plans are one thing, and their implementation is another. Ambiguously defined notions and concepts in regional planning have made frequent policy changes a characteristic of the Mexican system. It is agreed, however, that one of the general objectives of regional development is to extend some of the benefits of urban life to the smaller centres, and that growth should be achieved not only in market terms but in terms of the services to be provided by the new agglomeration.

We will see in Chapter 3 that with time and successive administrations, the geographical focus of the plans has become limited to industrial activities in the Lazaro Cardenas micro-region, and that the concept of development has become somewhat static.

All of this, of course, reflects normative preferences for action, with consequent changes in educational policies. Most authors discussing growth poles (see Darwent, 1975) agree that if an industry (or set of industries as in this case) is to act as a centre of development, it "must satisfy the three criteria of large size (and economic dominance), a rate of growth faster than that of the surrounding economy, and a high degree of interlinkage with other sectors. These three will give rise to transformations of growth through interlinkages and external economies between one sector and all others". In the case of the Conurbation, the first two requirements are met; the degree of linkage with the rural area, however, is very low, mostly limited to mining activities in iron ore, and some coal; sulphur, and phosphoric rock, and potassium are obtained from other regions of the country.

In Chapters 4 and 5 we will analyze problems related to 'enclave economies' and to a strategy which may partially resolve industrial and urban problems, but neglects the problems of the agricultural and rural communities. The increased heterogeneity which accompanies manufacturing can rapidly widen the existing inequalities in the region. In rural areas the polarization created by industrialization and tourism has become disadvantageous, mostly because of the very strong economic position of the urban areas, which enter into wage competition and produce selective rural outmigration (the young, skilled and better educated). It is not, therefore, only a problem of territorial relations, but of trying to confront problems of production and productivity in the countryside, inter-connections between urban industrial and rural agricultural, etc. Harmony between the national goals and the regional interests and aims is the goal.

Only the first steps in the study of the contributions of educational and training systems to development in the region are taken in this research. The process of industrialization, the agrarian structure, and the structure and dynamics of population are analyzed because they are considered fundamental in view of the relationships between education, training and industrialization in the process of development. Together with sociopolitical conditions, these are the factors through which limits, condition, and requirements for the development of the region can be set.

Ignoring these factors generally not only entails the risks of proliferating economic enclaves, but leads to situations in which growth, instead of alleviating tensions, facilitating political democracy and contributing to economic advances, in fact, aggravates socio-economic and cultural polarization and accentuates political conflict.

The last chapter of this section is dedicated to estimations of demand for human resources in the industrial activities of the Lazaro Cardenas micro-region. Only quantitative demand is considered, in several types of scenarios, and demand is analyzed by type of industry, distinguishing in each industry between two groups at the professional (university graduates) level: engineers/ scientists, etc. and administrative personnel/accountants; between technicians in the engineering and the administrative sectors; qualified workers - skilled workers and office clerks, and demand for unskilled workers is also estimated. Also included in Chapter 7 are some calculations on the national level of the supply and demand for professionals with university degrees for the year 1992.

Chapter 3: INDUSTRIAL DEVELOPMENT

1. Present characteristics of production structure and the strategy for development

The fostering of "poles of development" in a number of propitious regions is part of the Mexican government's general strategy which arose as the growth rate, and particularly the concentration of industrial production in three federal units - the Federal District and the states of México and Nuevo Leon - developed. Concentration has been so acute over the past few decades that the net value of the industrial production of these three entities reached 63% of the country's total by 1980 (1).

Hand in hand came social, political and economic problems, the most obvious symptoms of which were population concentration, environmental pollution, large-scale waste, and increasing difficulties in the supply of services such as housing, water, sewage and transport - in other words, a lowered general standard of living. Although less conspicious, dependence on foreign markets increased, along with a tendency toward internal market growth; where import substitution catered to a demand that followed the consumer patterns of the metropolises (quantitatively minimal but specific in its social composition). The industrial sector showed scant growth in job creation and a dangerous dependence on foreign capital and technology.

The much criticized "import substitution" model has produced these structural defects in the system, and in its aftermath, industrial crisis, concentrated distribution of income, aggravation of inequality on national, regional and social levels. As a result, the general strategy of the state has consisted in the mobilization of large amounts of capital toward a "pole of development" economic policy. These poles intensify the accumulation of capital through large industrial complexes geared mainly to the demands of foreign and national markets, and, only as a secondary consideration, to satisfying local and regional demands.

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(1) The figure for 1960 was 49%; for 1970 54%.

Politically, this strategy satisfies "nationalistic" requirements in that it means an intensification of investment by the State which, in conjunction with foreign capital, intervenes in those processes that allow the national economy to function in relation to international capitalist economies. Theoretically, the creation of these poles should result in benefits through the combination of the effects of general increases in production and productivity and the improvements associated with the redistribution of a population concentrated in the three areas mentioned above, in which, if the present trend in population growth were to continue, would support 40% of the nation's population of possibly 120 million by the end of the century.

Lazaro Cardenas is one of these industrial poles; it is conceived as a "conurbal zone", a consequence of endeavours in urban planning at a national level, and of the National Population Law passed in May 1976. This Law defines conurbial zone as "a region comprising two or more populated areas with a tendency to form a single geograhical, economic and social unit, going beyond the limits of one federal division (or state)".

A part of regional planning, urban planning is closely related to a concern that has its historical origins in the attempts to colonize the north of the country at the beginning of the 19th century - prior to the loss of almost half the national territory - and in the even more intensive efforts of the second half of the century, particularly during the era of Porfirio Diaz. But it was not until the 1930s that this type of planning became part of the government's six-year plans, designed to standardize economic and social activities on a national scale. Although the first plans consisted mainly of general guidelines "without specific overall or sectoral goals", not having at their disposal the "necessary means to supervise the operation (Solis, 1975), the political disposition and the programme itself were already clearly defined.

By the end of the Second World War, the plans had been formulated, based on models whose structure, in time, would become methodologically and theoretically more precise. As we will see later on, the history of these plans and programmes shows that although it is economically feasible to confront the problem of availability and optimal use of resources, the conditions determining the success of plans or programmes are even more dependent on the internal and external political forces which determine the conditions under which the planning is undertaken.

As regards the case that we are concerned with, it is important to point out that since 1947, government programmes initially followed the planning experience of the United States closely, particularly the Tennessee Valley Authority's model for hydrologic basins. Under the jurisidiction of the Ministry for Water Resources the following were created:

In 1947:
- the Papaloapan River Commission, covering 46,500 hectares which include areas in the states of Veracruz, Puebla and Oaxaca;
- the Tepalcatepec River Commission, covering 18,000 km in the states of Michoacan and Jalisco.

In 1950:
- the Santiago-Lerma River Commission, which covers parts of the states of Mexico, Querétaro, Michoacan, Jalisco, Guanajuato and Aguascalientes.

In 1951:
- the Grijalba River Commission, which covers parts of the states of Chiapas and Oaxaca;
- the Fuerte River Commission, covering parts of the states of Sinaloa, Sonora and Chihuahua.

In 1960:
- the Balsas-Tepalcatepec River Commission, that covers parts of the states of Oaxaca, Morelos, Puebla, México, Guerrero, Michoacan and Jalisco - an area of approximately 112,000 square kilometers. This commission absorbed the Tepalcatepec Commission, and its President was General Lazaro Cardenas.

Between 1970 and 1976:
- the National Commission for Arid Zones, and
- the Regional Development Committees (with territorial units within the States).

All these plans and commissions were formulated according to international agreements. Those of the 1960s followed the outlines of the Alliance for Progress, later ones those of the Interamerican Development Bank and the I.M.F. Within these plans the outlines were clearer and the goals more specific; the schemes included short-, medium- and long-term methodology. Their Achilles heel lay, perhaps, not only in the methodological problems discussed above, but in their follow-ups.

The history of many of these commissions is similar to that of Papaloapan, created under the administration of President Miguel Aleman, which developed study programmes to guide future development subject to the six-yearly changes in such a way that administrative rotation and the changes that implied alterations of perspective had repercussions in their capacity to change, even within the framework and the institutional continuity established by a party that had been in power for more than 50 years.

The Balsas-Tepalcatepec River Commission, however, is a somewhat different story. It would appear that the presence of General Lazaro Cardenas at its head (and this was so from the time he was President of the Tepalcatepec Commission) endowed this project with the drive and continuity that culminated at his death in October 1970 in the construction of the iron/steel complex that bears his name. The original project was ambitious, and the resources assigned to it considerable. Its area of reference was very broad and it considered diverse sub-regional problems. Although the objectives were general, and hardly concerned the problems of the region that concerns us, a number of projects were developed that were to intensify its development: the building of the Infiernillo and La Villita Dams, the organization of the cocunut industry, the building of roads, the studies of iron reserves and the feasibility of their exploitation in the production of steel. Since 1957, the Tepalcatepec Commission has entrusted Casa Krupp with a project for the construction of an iron and steel plant near the Las Truchas iron deposits (Lazaro Cardenas Municipality, then known as Melchor Ocampo del Balsas municipality). These studies were resumed in 1963 by the same company, and in 1968 by SITSA and an English Company (John Miles). In August 1971, the project was initiated, in 1973 the construction of the industrial plant was begun, and by 1976 steel was being produced (1).

When steel processing began, the organization in charge of coordinating development in the area was no longer the Balsas River Commission but the Conurbation Commission of the Lower Balsas River. The territory covered was now only 11,600 square kilometers, comprising the Tt. José Azueta, Coahuayutla and La Union municipalities in the state of Guerrero and Arteaga and Lazaro Cardenas in the state of Michoacan.

Reorganization plans comprised activities in the three sectors of the economy, and the model proposed now was different from the Balsas River original. The strategy was geared to regional development, and contradictions between political speeches on development and the reality of the area were pointed out. It was stressed that problems associated "with investment, although pertaining to the national interest, were, in real terms, far from representative of the development of the local majorities and could hardly be remedied through urban organization divorced from the overall development of the region". It was also explicitly stated that the scope of the technical commission was local, and that it should promote genuine regional development, which will occur in a situation in which the commission "becomes involved in the whole problem and in the defense of the interests of the native population faced with a modernization process decided upon long before; takes into account the demands resulting from the rationalization of problems; determines who should benefit from and who should subsidize the growth of the centres; channels popular aspirations towards definite programmes of action." (See CONURBAL, Secretanado Tecnico, 1982.)

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(1) For further details see Godau, 1982; Minello, 1983; Zapata, 1978.

What is certain is that the Commission was concerned with carrying out a series of important analyses, among which were the following:

- aerial photography of the area,
- analysis of land tenure,
- ecological planning to determine the physical characteristics of the environment and of the land, its potential and present uses,
- human resources and community organization in rural areas,
- planning alternatives for formal and non-formal educational services,
- assessment of tourist development alternatives in Caleta de Campo.

It is also true that the commission had very little power and few resources. Without entering into an evaluation of its political perspectives, the commission was in fact in direct conflict with politicians, admnistrators and planning experts at other levels and in other government agencies. Diagnosis-censure was confused with diagnosis-identification, and finally, independently of the objective truth or correctness of the point of view, what was to define the course of future actions was, as usual, the power differential possessed by one or the other of the interested agents of change in the area, and here SIDERMEX, NAFINSA and other agencies had by far the greatest political power.

For the purpose of analysis, the conurbation was divided into three micro-regions: a) the industrial region of Lazaro Cardenas, where the large pojects were concentrated; b) the tourist region of Ixtapa-Zihuatanejo, where the most important influence was the coordinating state tourist organization (FONATUR); and c) the rest of the region, predominantly involved in agro-industry and mining, and in which a great variety of agencies intervened (see Chapter IV). This will help to explain the course of events as regards organization, and the development patterns that were to be imposed on the area.

For the industrial point of view of planning, the pattern followed the natural logic of industrial construction.

The rural was subordinated to the urban, the urban to the industrial and the industrial to the sectoral. The intention was to produce steel, fertilizers, etc. As compared to growth, development was considered a mere epiphenomenon.

Although still active, the Conurbation Commission was replaced as from 1979 by the general management of Industrial Ports, whose predominant tendency was urban-industrial. Regional development was then limited to the micro-region of Lazaro Cardenas, and decisions regarding the construction of the port were left to the industrial and financial agents (SIDERMEX, NAFINSA, and ICA) and to federal government programmes which, by then, were under the considerable influence of the vast resources made available by the oil boom. For short-term pragmatic reasons, the wetlands of the Cayacal, La Palma, and De Enmedio Islands were chosen for the construction of the industrial port. Ecological considerations were overshadowed by the purely economic, and very little attention was paid to the real or potential effects of lack of control over the flow of industrial waste into the sea.

It is not our intention here to condemn the important industrial port programme or industrialization, but the trend that was observed in the area was clearly "company town" or "enclave" mentality.

Nevertheless, with the advent of the oil and financial crisis, and the rise of President Miguel de la Madrid, the Industrial Port Programme lost importance, leaving a whole area still undefined as to which bodies would be in charge of coordinating the project.

2. Development centres, industrial complex and the industrial port

Three very similar concepts, originating in the 1950's from the problems of inter-regional development imbalance, constitute the theoretical basis of the government programmes:

- "poles of development", originating in the work of François Perroux (1955);
- "industrial complex", from Soviet planners;
- "industrial port", as a result of the changes of scale in maritime transport and handling technology for the loading and unloading of liquids and solids.

The concept of development centres has considerable theoretical range; it attempts to find a solution to problems associated with imbalance in regional development and hypertrophy of cities which, like Mexico City, suffer from large concentrations of industry, commerce and services, and consequently of population. Decentralization might be possible through large-scale investment, which would promote the growth and dynamism of a rationally scaled economy, increased production and productivity, and openings on the world market. This is an economic concept, focused on imbalance in the framework of inter-regional development, which, as time has gone by, has broadened to include aspects of social development. The multiplying effects of large-scale industrial activities would include increased contact with neighbouring areas. The Hirschman hypothesis proposes that this induced change would, for example, be characterized by an essentially unbalanced development, brought about by a succession of conditions of imbalance. In other words, by means of intra-regional commerce and transfer, of capital, the centres of growth would set forces in motion that in time would stimulate development in the more backward areas. The theory of the propagation of impulses and innovation is implemented through mechanisms such as growth along transport routes, for example, which with the increased traffic of inter-regional trade, would reach full-scale economies, which in turn stimulates trade, which increases traffic, etc. Agriculture close to the main routes would then benefit from easier access to larger markets, and from the greater likelihood of contact with agents providing information and know-how on scientific, technical and cultural innovations. Expectations of diffusion of innovation are tied to a whole theory linked to the concept of centres. Modern industrial development would not only bring about cultural change in the urban areas, but transform life styles, customs and socioeconomic relationships as far off as the agrarian regions.

In as much as industrialization is essentially a process of technological innovation, the diffusion of innovations, beginning with their dissemination should eventually result in their being adopted, and then in improvements in organization, specialization, division of labour, etc. However, the relatively simple idea of decentralization of growth from the areas of hypertrophy runs into problems in that the effects of polarization and of backward conditions alongside advanced ones persist, and enclave economies are the product of situations where the expected spontaneous diffusion and multiplying effects do not come about, and accumulative processes push development in the company town and recession in the adjoining areas.

But it is important to underline here that Lazaro Cardenas, was conceived, as part of state strategy, as a development centre not only on a regional scale but also at national level, and it is here that the "industrial complex" and "industrial port" concepts combine. The concept of the industrial complex is not as broad as that of the development centre in the sense that it is clearly economic with no specific pretensions to attaining equilibrium with other production factors. Defined as "an ensemble of technically and economically interconnected industrial units, usually situated in a given territory", it is characterized by the fact that "this sort of complex is normally planned, based or on common physical infrastructure with, and developed around, a main industry which consistitues the nucleus or focal point of the complex" (Gohman and Karpov, 1977). In the case of Lazaro Cardenas the nucleus is the Lazaro Cardenas-Las Truchas steel industry around which have arisen NKS, PMT and other industries whose basic input is steel. In the Industrial Port Programme, other "mother-industries" were to appear as we will see later on.

The industrial port concept arose in the 1950s from the transportation of large cargoes in supertankers and of the merchanization of this process by means of roll-on/roll-off systems (see Mexico, 1980, and Mexico, undated). Here, an industrial port is not only a place for transferring merchandise, it is designed for purposes of industrialization and decentralization of activities, i.e. "a project that comprises everything from industrial parks to what is, strictly, speaking, maritime infrastructure. The port of Lazaro Cardenas, and the two that are planned for the medium-term (Altamira-Tampico, in the Guilf of Mexico at the mouth of the Panuco River and Ostion-Coatzacoalcos, on the Isthmus of Tehuantepec in the Gulf of Mexico at the mouth of the Coatzacoalcos River) closely follow the model of the industrial ports of Jurong (Singapore), Kashima (Japan) and others that have been undertaken under the auspices and with funds of federal governments through special organizations that have taken over the construction, design, and control of the infrastructure related to the industrial activities. This is conceived as promoting decentralization by allowing much more intensive and efficient use of natural advantages - abundance of water, proximity of raw materials, low-cost land, etc. - all of which would contribute to economies of scale by bringing the industrial activities close to the resource. Added to this are expected increases in efficiency and diversification of production, along with an increase in exports, at highly competitive international rates. The concept of industrial port combines with that of industrial complex, and large-scale savings are added to the potential of outward development encouraged by the possibility of transporting large volumes; concentrating basic industrial plants such as iron and steel, basic chemicals, petrochemicals, industrial grains; and developing secondary industries. As the concept of the industrial port is important in this work, it will be explained in greater detail, with reference to the Lazaro Cardenas Industrial Port in particular, below.

3. The Lazaro Cardenas Industrial Port

The port infrastructure is made up of breakwaters, access channels and turntables that will initially accommodate ships of up to 100,000 tons dead weight, while extensions have been planned to cope with ships of even greater tonnage. The first stage of industrial urbanization has been completed and covers 400 hectares, which include subdivisions, paving of the streets, street lighting, sewage, electric installations, water for drinking and for industrial use, etc. In the second and third stage, the urbanization of another 900 hectares has been planned (see Map 5). The plants to be found within the industrial port are the following:

- SICARTSA (Lazaro Cardenas-Las Truchas Steelworks): state-owned majority (51% federal government, 25% NAFINSA, 12% Altos Hornos de México, S.A., and la Perla, and 12% the NAFINSA trusteeship). Project to be undertaken in four stages.
  The first stage, completed in 1976, for the production of non-sheet laminated steel (corrugated rods, bards, light frames, wire, etc.), mainly for the construction industry. The installed capacity of this stage is 1.3 million tons. Assistance in production techniques was provided by Altos Hornos. In the construction stage during peak-periods, 18,000 workers were employed; there were permanent jobs for about 5,000 workers. A second stage still in the process of construction envisages the production of sheet steel using the direct reduction method (electric furnace) with an approximate volume of about 1.5 million tons; operations will begin between 1984 and 1985. It will provide permanent jobs for another 5,000 people and at peak periods of construction it will employ around 21,000 workers. A third stage originally planned to be built during the 1982-1988 period (but work has not yet been approved, let alone begun) will add an annual capacity of 2.85 million tons which will probably be used in the production of tinplate. Last, a 4th stage, originally scheduled to begin in 1988, will comprise an additional production capacity between 3.5 and 4.5 million tons. That is to say, the original plan was that by 1995 the plants' production capacity would be between 10 and 11 million tons of steel.

The derivative industries are involved in the manufacture of sheet steel, boat building and repair, and the manufacture of boilers, turbo-generators, steam turbines, transformers, motors and compression engines, equipment for handling materials, and mechanical tools. Several of these companies have already been authorized to invest in the port, but only a few of them have begun to construct plants. These are:

Productora Mexicana de Tuberia - in which both national and foreign capital is invested (34% Nacional Financiera, 26% Sidermex, 40% Japanese capital - Sumitomo Metal Industries). The type of product to be manufactured is soldered steel pipe with outside diameters of 16 to 48 inches, in 40-foot lengths. Initially, 290,000 tons will be produced annually, with an expansion to about 400,000 tons. The company will create jobs for 1,100 people. The construction stage will be completed over the next few months and in October 1984 it is hoped that the plant will begin production.

The activity of NKS (1), with both national and foreign capital invested (33.5% NAFINSA, 33.5% SIDERMEX, 33.0% Kobe Steel Corporation), will consist of heavy machinery construction, an iron foundry, and steel manufacturing. Initial production will be 93,000 tons of molten steel, 20,000 tons of cast steel, 20,000 tons of forged steel (for the construction of turbines, turbogenerators, forged axles for transport vehicles, rollers, etc.) and 120,000 tons of heavy manufactured steel. The plant will create permanent jobs for 2,000 people. The construction process will be completed in the next few months and by October 1984 it is planned that the plant begin operations.

- CELASA (Constructora de Equipos Latinoamericanos): project approved but not begun, for the manufacture of offshore marine oil drilling equipment. The project contains plants with annual capacities of 40 to 60 units of 1,500-3,000 tons each. The industry will provide permanent jobs for about 620 people. In 1979, the total investment was estimated at $2,224 million pesos.

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(1) Nippon Kobe Steel.

- Astilleros Unidos Mexicanos: project approved but construction has not yet begun. Designed to build 250-metre boats, it will build and repair vessels of 80 to 120,000 tons dead weight capacity. Neither the total invested nor the number of workers required by the industry are known.

It is foreseen that with the programmes to be initiated as a result of this dynamic large-scale industry, and taking into account only those related to the iron and steel industry, the following factories are considered 'possible', that is, there is an infrastructure but as yet no programmes or commitments:

- Pressure vessels
- Rollers
- Auto parts
- Heavy machinery for the construction industry
- Containers, packaging and equipment for industrial security
- Motors and compressors
- Boilers
- Steam turbines
- Turbo-generators
- Transformers
- Machine-tools, etc.
- Ferrous alloys.

These factories would be supported by workshops for cast-iron parts, steel manufacture, manufacture of special steel and forged steel parts.

Another of the important parent industries whose construction stage is already completed is Fertimex. Fertilizantes Mexicanos, S.A. manufactures fertilizers and intermediate products such as sulphuric, phosphoric, and nitric acid. The semi-state industry, Fertimex, el Instituto Mexicano del Petroleo and the foreign companies, Lurghi Chemie, Udhe and Gulf and participating in the project, which includes the construction of seven industrial plants for phosphate and nitrogen fertilizers, as well as intermediate products for their manufacture. Plants included in the first, already completed, stage, which will soon begin production are a) the sulphuric acid plant, with an estimated annual production of more than 660,000 tons, b) the phosphoric acid plant with an annual production of 198,000 tons, c) plants to produce nitric acid (210,000 tons annually), ammonium nitrate solution (270,000 tons annually), and solid ammonium nitrate (200,000 tons annually), diamonic phospate (270,000 tons annually) and NFK complex fertilizers (250,000 tons annually).

A second stage will double the production of sulphuric and phosphoric acid, and the production of a fourth plant will be added; apart from producing 436,000 tons of triple superphosphate annually. The inputs for these plants come from various states of the Republic: sulphur from Veracruz, phosphoric rock from Northern Baja California, potassium chloride and sulphate from Northern and Southern Baja California. It is hoped that anhydric ammonium will be derived from natural gas and provided by the plant to be installed at the industrial port; in other words, the production of ureic nitrogen solutions will depend on the feasibility of the PEMEX project. The cost of the project in its initial stages is estimated at 10,160 million pesos (1979) and the plant will create permanent jobs for about 1,100 people.

In the area of BASIC PETROCHEMICALS:

PEMEX may install a terminal for the storage and distribution of its products to such industries as paints and solvents, chemicals to be used in steelworks, upgrading benzon and tar, and explosives.

Latex was to install its solvent and paint plant, but neither its products, nor the amount of investment have been specified. Twenty hectares have been assigned to the plant in the industrial zone of the port.

In the food industry:

CONASUPO is building a grain terminal, storage units, installations for loading, unloading and transportation of grain and seed, on 115 hectares. They are also building an agro-industrial complex which will product 99,000 tons of salt, 99,000 tons of animal feed, 99,000 tons of wheat flour, 99,000 tons of maize flour, 99,000 tons of oil and lard, 35,000 tons of bread, 17,000 tons of biscuits and pastas and 4,000 tons of soap and detergents. It is estimated that it will create permanent jobs for 600 people. Construction of the complex began in 1982, and several of its storage installations are already finished. The industrial phase will begin operations in 1984.

Although the dynamism of CONASUPO will depend mainly on inputs from overseas, the natural resources of the region will allow the expansion of other projects, for which some small factories related to the food industry are already installed; among the most likely are:

- processing of essential oils
- fruit canning
- coconut, copra and sesame seed
- pasturization of milk
- sausage and cold meats
- sweets
- fish canning.

There is also a fishing port already built for 320 small vessels, 20 coastal and 11 deep-sea vessels, which will encourage the intensification of fishing activity, particularly in the coastal and deep sea areas, which have been little exploited and apparently have considerable potential.

Other industries: CEMENTOS ANAHUAC has a 20-hectare allotment to construct a terminal for the bulk distribution of cement. The project has not been defined, but it will be supported by a set of projects for which technical studies have already been done.

Mexican Maritime Transport: while the port was under construction, the installation of the necessary infrastructure for the transferral of a naval base from Acapulco to Lazaro Cardenas was proposed.

Summary

Until 1983 industrial activity depended basically on the production of steel by Lazaro Cardenas-Las Truchas plant, the first stage of which was completed in 1976 with an installed capacity of 1.3 tons of non-sheet steel. The second stage, destined to produce sheet steel, is still under construction, and by 1984-1985 it will have the installed capacity of 1.5 million tons. The NKS and PMT plants are in the process of completion, and should begin production in the latter part of this year. There have been some problems with ammonia, but otherwise inputs needed for the other plants are all supplied, from other regions of the country.

Most of the infrastructure of the industrial port has been completed and expansion into the Palma Island area will depend on the time it takes for those projects not directly related to the steel industry to become established. Considering the generalized recession in the country, Lazaro Cardenas may still be considered to be growing fairly dynamically, although not on the scale that was forecast during the oil boom, in the light of the Lopez Portillo government's very liberal management, accelerated industrialization and large-scale investment. Job creation continues intensively in the construction industry, but if new projects are not initiated, there will be considerable unemployment in this sector when the projects at present under construction are completed.

4. Tourism

The tourist area is situated in the Ixtapa-Zihuatanejo area, 150 kilometres south of Lazaro Cardenas and 200 kilometers north of Acapulco. In early 1975 this fishing village had 265 hotel rooms. By the end of 1982, investment in tourism had brought the number to 3,343, and another 500 first-class rooms had been added in 1983. From 33,000 visitors registered in hotels in 1975 there were almost 308,000 in 1982.

The annual figures are the following as shown in Table 21:

Table 21 - Hotel guests and accommodation

	1975	1976	1977	1978	1979	1980	1981	1982
Number of rooms	491	795	884	1 327	1 497	1 758	2 486	3 346
Guests Registered in hotels	33 545	64 879	91 505	122 951	158 300	207 254	217 755	307 911

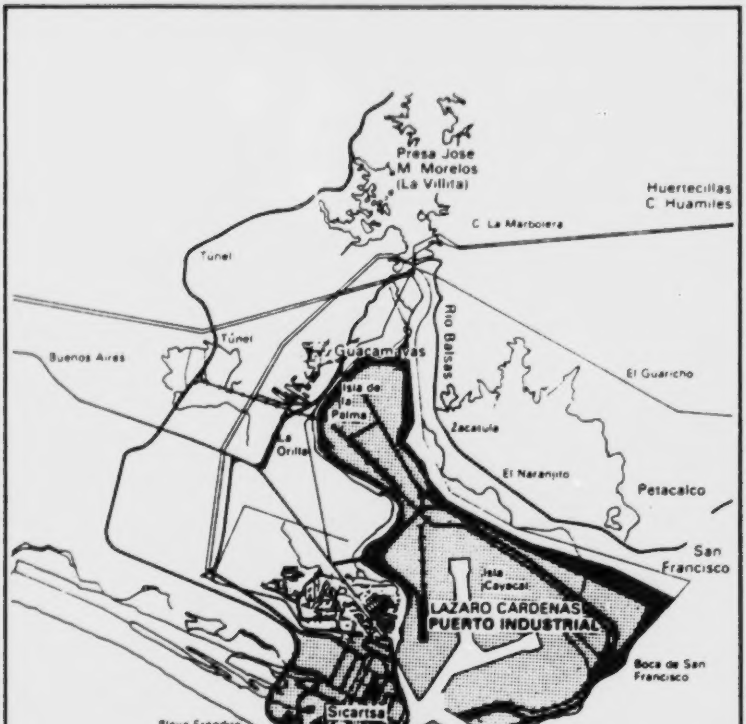
Source: FONATUR, Direccion de Planeacion economi co-urbana, 1983.

The rate of increase in the number of hotel rooms is extraordinarily high - 61.9% between 1975 and 1976, 11% between 1976 and 1977, 41.4% between 1981 and 1982, and 34.6% between 1982 and 1983 - and this dynamic growth would appear to be intensifying at present as a result of the devaluation of the peso in relation to the dollar.

The hotel industry creates both "direct" and "indirect" employment, the majority of indirect jobs being related to tourism. Rough estimates indicate that each room creates one direct and five indirect jobs.

The intensification of tourist activities could generate even more indirect jobs, particularly in the rural sector in activities related to the supply of raw materials. However, there are even greater problems here; the hotels (particularly first-class hotels) are obliged to obtain their supplies of vegetables, fruit and other goods from markets in Mexico City, because they are the only ones that guarantee the quality of their products, and continuity in the supply.

We acknowledge the importance of the whole problem of tourism and growth, and the necessity for avoiding a repetition of the well known situation in which islands of international luxury thrive in the midst of rural poverty. At first glance it would appear that Ixtapa-Zihuatanejo does not suffer from this problem to the same extent that, for example, Acapulco has, but in fact, we do not have the elements necessary to form an objective judgement.


Presa Jose
M Morelos
(La Villita)
Huertecillas
C Huamiles
C La Marbolera
Túnel
Túnel
Rio Balsas
Buenos Aires
Guacamayas
El Guaricho
Isla de
la
Palma
Zacatula
La
Orilla
El Naranjito
Petacalco
San
Francisco
Isla
Cayacal
LAZARO CARDENAS
PUERTO INDUSTRIAL
Boca de San
Francisco
Sicartsa
Playa Erendira
Playa Bonanza
Isla
de
Enmedio
Punta Cayacal
Muelles
Zona Ecológica
Carreteras
Ferroviarias

Chapter 4: THE AGRARIAN STRUCTURES IN THE CONURBATION

1. General characteristics

The rural area comprises a little more than a million hectares, in the shape of an arch between the two poles of development, the Lazaro Cardenas industrial pole and the Ixtapa-Zihuatanejo tourist pole. Investment and the resulting transformations of the now-urban sectors have had important repercussions on an area that, until less than ten years ago, was a simple agricultural economy.

The agricultural sector, which until now has never been considered systematically, but only from the point of view of the programmes and activities of a few government agencies (whose results we will analyze below) suffers the repercussions of the emergence of urban enclaves. A number of optimistic economic theories insist that the logic of this growth is such that these repercussions do not occur simultaneously over the whole region, but spread or are induced (through inter-regional trade and the transfer of capital) from the more developed areas to the more backward ones (see Hirschman, 1958). The sector should first experience accelerated growth at its poles, and growth should then spread toward the interior, eventually affecting the entire area. Other, more pessimistic, theories (such as Myrdal, 1957) predict that the spontaneous diffusion of development is polarized - the fortunate areas near the poles advance, and the backwardness of the hinterland is aggravated.

Pucciarelli, Zapata and Padua (1981) reached conclusions that were closer to the pessimistic hypotheses than to the optimistic ones, but through a logic different from that proposed by Myrdal. It is true that there is a strong tendency towards polarization between the coastal and the mountain sub-regions, but its distinguishing characteristics emerge mainly in an urban-rural interaction which affects practices and modes of production. Generally speaking, peasant economies with all their implications of slow development of production, traditional technology, virtual lack of development in trade and organizational enterprise, backward and depressant use of the soil, and obsolete social relationships and non-technical work methods (all in a general atmosphere of poverty and want), are still prevalent, although modified in areas lying close to the urban or industrial poles.

The technological backwardness typical of the rural areas, together with the installation of poles of industrial growth precisely in the area of highest agro-industrial potential, make it necessary to define the rural area as two sub-regions, the coastal and the mountain areas, whose characteristics and evolutions differ one from the other.

The natural logic of the two sub-regions is identical in the sense that both are subject to dominant conditions (topological, edaphological and climatic in the mountains, and speculative and hedonistic on the coast). Both rationales are based on the line of least resistance, the products of reinforced habits, attitutdes, values and objective conditions that eventually encourage polarization and discourage those conditions that would favour integration and regional development. Also, certain distinctive features are accentuated and thus lead to the divergence of the internal development of one sub-region from that of the other.

In the coastal sub-region, capitalistic attitudes toward labour organization, production, market relationships, etc., although they do force traditional crops and agricultural practices further and further into the mountain region, are losing strength as time goes by. It is the evolution of the neighbouring urban areas which demands growth in industry and services at a rapid rate, making it impossible to plan expansion, qualitatively or quantitatively, in the short or medium term. The still simple agricultural economy of the mountain sub-region lacks raw materials and the knowledge necessary to adapt to the demands of a constantly growing population. Productivity is low, yields are decreasing, and surplus population is still coming in. Under such conditions, the endemic problems of underemployment, undernourishment and poverty have little hope of improvement.

Agrarian production in the conurbation thus tends to repeat the general patterns of the sector in other parts of Mexico: traditional crops and self-supporting economy are being pushed towards the seasonally rainfed areas, while the best land is reserved for permanent plantations. Shortcycle seasonal production of basic foodstuffs persists in the mountainous zone, and in coastal and irrigated areas these crops are replaced with fruit trees. As time passes the divergence will tend to get worse.

The coastal sub-region comprises the belt of flat and semi-flat land on the coast from 4 to 200 metres above sea-level. According to studies undertaken for the "Ecological Plan for the Conurbation of the Lower Balsas River", two areas in this belt stand out as being particularly suitable for intensive agricultural activity. One of them, near the Lazaro Cardenas pole, is part of the district irrigated by the J.M. Morelos dam, and at present covers 16,000 hectares; the other is near the tourist pole on the Ixtapa Bay. The rest of the coastal belt in general has good chances of developing short-cycle seasonal crops and about average potential for agricultural and cattle production. This is particularly rough for coastal land and lends itself well to cattle grazing. But there is a good deal of erosion due to the systems of production in use. The most dynamic area of this belt is the town of La Union in the State of Guerrero.

The mountain sub-region comprises a stretch of the southern Sierra Madre that runs parallel to the coast, with altitudes of over 200 metres above sea-level, averaging 1,500 metres for the whole sub-region. It encompasses the area of the municipalities of Coahuayutla in Guerrero and Arteaga in Michoacan, two-thirds of the municipality of José Azueta and a little more than half the municipalities of Lazaro Cardenas and La Union. There is great variety in the relief of the land, which ranges from the steep hills in the Coahuayutla and José Azueta municipalities to the lower valleys and hilly land suitable for crops and livestock. The area that is defined as being apt for agriculture is only 10% of the total; of this, only a quarter is used for short-cycle seasonal farming, the rest as natural pasture for livestock.

Agricultural activity, subject to the geographical conditions of the sub-region, is traditional, and the very low production is locally consumed. It is here that the poorest peasants of the Conurbation live and wander year after year over the mountainous slopes, searching for a place to sow a small maize crop to be cultivated with an espeque. This ancient method consists of making a hole in the ground with a stick, planting a seed, and hoping that it may germinate.

Demographic pressure and precarious natural conditions, added to the general lack of education of the people, combine to form economies based on the farming of impoverished land, small-scale forestry for the supply of firewood for everyday heating and cooking, and range cattle-farming.

Systems of agricultural expansion are of the swidden or 'slash-and-burn' type, which causes even greater exhaustion of the soil, leaving it sterile in very short periods of time and making it imperative that the process continue. The illusion of creating new frontiers and space for agriculture is nothing more than the further rupture of an already fragile balance between the production of foodstuffs and the reproduction of natural tropical conditions. These factors combine to hasten the deterioration of the environment, which in turn yields less and less.

2. The agrarian area and use of the soil

The extent of the area defined as apt for agriculture varies with the estimations, but it can be stated fairly confidently that there are about 100,000 hectares of arable land, if to the surfaces already planted (63,000 hectares), are added those adjacent, and those lying fallow. These lands are strewn throughout the two coastal sub-regions, particularly the irrigation district of the J.M. Morelos dam. The Lazaro Cardenas micro-region has the most promise in agriculture, having fertile soil as well as abundant water resources and irrigation systems. Here it would be possible to implement modern technology and intensive agriculture, which in time might satisfy the demand, not only locally but on the regional level.

Assuming no major ecological problems or limitations in transport and communications, and excellent trade prospects, there will be a problem here of social and political limitations, and some negative effects related to the industrial development of Lazaro Cardenas and Ixtapa-Zihuatanejo, particularly as regards the general effects of growing urbanization; we shall return to this in detail further on.

Most of the farmland is used for short-cycle seasonal crops, depending therefore on the rains for watering. Water reserves are greater on the coast than in the mountains, where the biggest problem is drought. Sprinkling systems are almost non-existant, and the problem of water is that which features most often in rural requests for aid from government agencies. To give an idea of the dimensions of the problem, only 900 of the total of 100,000 hectares is classified as 'wetlands'.

Grazing area for livestock is calculated to be about 750,000 hectares, of which only 21,000 are cultivated pastures. The rest of the land is unexplored, inaccessible, sterile. It is generally not classified as private or ejido property, but as belonging to the federal government. There are discrepancies in the municipal data, but of the total area, probably about 500,000 hectares are communal (ejidal) and 300,000 private or freehold property (see Table 22).

As regards cattle-farming, a number of ejidal community enterprises and several private business in the coastal sub-region have taken an important step toward modernization by increasing natural and cultivated grazing areas and using creole cattle crossed wih breeds such as the zebu, that are able to withstand ecological conditions in the mountainous areas and serve the purposes of both milk and meat production. There are still very few feed lots and sanitary installations for improving the health and productivity of the cattle, and those that do exist are limited to the coastal areas.

3. Production Units

According to official data, in 1979 there were 10,946 production units, of which 8,817 (80.5%) belonged to ejidos and the rest to private estates or ranches. These estimates are somewhat deceptive in that, one way or another, the units are under the control of some state organization that makes legal arrangements for the use of the land. The character of swidden agriculture and cattle-farming that predominates in the mountainous areas, added to the illegal and semi-legal uses of ejidal land as a result of demographic growth, etc., require that the calculations be accepted with some caution. Specific situation will be described in some detail below.

Certain estimates of persons obtaining more than the legal limit of land and the predominant type of community plots could reinforce the impressions of those who regard the reality of distribution as wide of the theory, particularly as concerns smallholdings. In fact, if the members of a family are considered as a single unit; we would find that some 160 landowners control approximately 170,000 hectares of summer pastureland (52% of the land in private hands and 21% of the total of this type of land). At the other extreme, there are actually a large proportion of producers who carry out their activities in plots of no more than 25 hectares. Here the type of land is very important, since the large marjority of the ejido farmers are smallholders, whereas private producers occupy the majority of the medium-sized plots of land (between 100 and 500 hectares) and all the large plots (over 500 hectares).

As we will see below, demographic pressure on land resources is ever-increasing, particularly amongst the small farmers, who relieve pressure by leasing more land, by using the dubious slash-and-burn method already mentioned, or by migrating towards the poles or other urban areas of Mexico or the U.S. The original structure of land tenure in the ejidas of the Conurbation is rapidly being modified by two divergent though complementary processes: the tendency toward concentration of property (which is accompanied by private seizure of communal land) and the fusion of family plots provoked by impoverishment of the soil, demographic pressure and overworking of the soil as a result of the use of archaic techniques.

4. Type of production

Short-cycle crops are grown on about half the total agricultural land - mainly maize (40%) which, with average

Table 22: Land use in the zone, by municipality and type of landholding. 1980

Munici-pality	Type of landholding	Total	Agriculture				Livestock			Forestry	Unused	Unpro-ductive	Fundo Legal*	Multiple Uses
			Wetlands	Irrig.	Seasonal	Total	Intens.	Extens.	Total					
J.Azueta	(*)Ejidal	128 586	220	140	9 400	9 760	2 850	72 350	75 200	21 700	11 255	5 332	4 019	1 320
	Private	57 790	120	90	2 700	2 910	2 200	37 000	39 200	8 100	3 530	3 450	300	300
	Total	186 376	340	230	12 100	12 670	5 050	109 350	114 400	29 800	14 785	8 782	4 319	1 620
Coahua.	Ejidal	222 567	250	500	10 392	11 142	50	94 716	94 766	8 953	73 442	34 014	250	
	Private	45 000	s/d	350	3 200	3 550	s/d	36 400	36 400	s/d	s/d	5 100	s/d	s/d
	Total	267 517	250	850	13 592	14 692	50	131 116	131 166	8 953	73 412	39 114	250	
La Union	Ejidal	139 271	90	2 120	7 150	9 360	14 500	62 779	77 279	22 799	22 079	6 814	126	814
	Private	40 374	220	780	2 860	3 860	1 600	29 060	30 660	2 940	1 000	1 414	-	500
	Total	179 645	310	2 900	10 010	13 220	16 100	91 839	107 939	25 739	23 079	8 228	126	1 314
Artega	Ejidal	157 608	s/d	50	3 314	3 364	s/d	122 720	122 720	24 012	4 262	2 865	385	s/d
	Private	235 718	s/d	100	3 385	3 485	s/d	186 652	186 652	30 110	7 040	8 431	s/d	s/d
	Total	393 326		150	6 699	6 849		309 372	309 372	54 122	11 302	11 296	385	
L.Carden	Ejidal	58 857	s/d	7 148	5 352	12 500	s/d	40 956	40 956	1 253	822	2 195	631	s/d
	Private	51 795	s/d	1 112	2 420	3 532	s/d	44 268	44 268	1 929	674	1 023	369	s/d
	Total	110 152		8 260	7 772	16 032		85 224	85 224	3 182	1 496	3 218	1 000	
C. Region	Ejidal	706 389	560	9 958	35 608	46 126	17 400	393 521	410 921	78 717	111 860	51 220	5 411	2 134
	Private	450 727	340	2 432	14 565	17 337	3 800	333 380	337 180	43 079	12 244	19 418	669	800
	Total	1 157 116	900	12 390	50 173	63 463	21 200	726 901	748 101	121 796	124 104	70 638	6 080	2 934

Source: Based on data from the "Inventories of Land Resources". District of seasonally rainfed lands, Lazaro Cardenas and Petatlan. SRA.

(*): 'Fund legal' is the land in the Ejido System for housing and other communal uses.

Table 23: Total hectares under the "Ejido" system of land tenure, by municipality, conurbal zone of the Lower Balsas River, 1980

Municipality	SURFACE (in hectares)					No of land plots	No. of Beneficiaries
	Total	Seasonal Rainfed	Summer Pasture	Unbroken	Others		
Arteaga	37 191	5 270	25 750	156	6 014	157	533
L. Cardenas	52 739	10 381	27 617	4 861	9 880	609	1 033
J. Azueta	135 809	21 791	109 829	3 139	1 050	1 377	3 281
Coahuayutla	156 145	22 956	119 672	50	13 467	936	2 294
La Union	101 774	18 653	68 984	4 471	9 666	1 333	1 647
Conurbation	483 658	79 051	351 852	12 677	40 088	4 417	8 788

Source: Catalogue of the Peasant Property in a Study on Seasonal Rainfed Lands Tenure (preliminary version), 1980.

yields estimated at 1.3 tons per hectare, constitutes the greater part of the production. Sesame, a cash crop, follows in importance, beans, chiles, tomatoes, watermelon and peanuts are grown in much smaller quantities (see Table 24).

Permanent crops are grown on about 20,000 hectares, primarily 14,000 hectares of coconut palms, mostly along the coast. Non-traditional permanent crops (bananas, mangoes, papayas and limes) occupy about 6,000 hectares, which have gradually extended to include the sub-regions near Lazaro Cardenas, where bananas are usually grown between the coconut palms. Coconut usually brings in around 15,700 pesos per hectare (1980), that is, considerably more than maize (approximately 6,200 pesos per hectare) and sesame, but much less than the fruit trees which brought in around 50,000 pesos in 1980. Mango and papaya brought in the most - 72,000 and 75,000 pesos, respectively. This type of primarily coastal crop is usually controlled by private producers (75% of the modern plantations), whereas coconuts are the main crop in the ejidos along the coast (62% of the plantations).

Cattle production is fairly high and increasing with time (Table 25). The production of beef cattle, which is the traditional activity of the mountain municipalities, is particularly important as regards volume and value. In general, technicques of feeding, maintenance and breeding are rudimentary; yields, particularly of milk, are low, and complementary feeding with natural fodder is virtually non existent. There are no systems of storage and distribution of water which would minimize the energy used in moving the cattle over the hills; there are no pasturelands, and often the land is not even fenced. There are almost no veterinary services for vaccinations and disease control, and there are not even dipping facilites on the ranches for the control of ticks. The cattle are therefore mangy and thin, many of them are diseased. In short, they are not very productive.

Poultry- and pig-farming resembles cattle-farming: poor breeds, low yield, badly managed resources and a system of free-range in regions with very high temperatures. Pigs and chicken wander freely among people in search of food, which results not only in low yields but in parasitic diseases. Obviously there are no appropriate installations for breeding.

A few ejidal fishing activities are found along the coast and near El Infiernillo dam. Fishing is done in small boats and there are ambitious plans for deep-sea fishing. But although conditions appear to be good, the fishing potential is not being developed. In the medium and short run there will be serious problems in the coastal areas near Lazaro Cardenas, some pertaining to the industrial and urban waste that is being and will continue to be discarded, particularly by the iron and

Table 24: Cultivated land and value of production in the Conurbation, 1980

Product	Cultivated Surface (in hectares)	%	Volume of Production Tons	Value of Production (in thousands of dollars)	%
Maize	19 320	43.9	24 366	108 428	16.4
Sesame	2 747	6.2	1 585	18 229	2.8
Beans	698	1.6	462	5 548	0.8
Peanuts	689	1.6	838	4 625	0.7
Fruits & Vegetables	176	0.4	2 234	11 640	1.8
Sorghum	623	1.4	.748	2 170	0.3
Coconut	13 750	31.3	24 000	216 000	33.7
Banana	1 830	4.2	46 800	117 000	17.7
Mango	1 500	3.4	18 000	108 000	16.3
Papaya	545	1.2	10 260	41 040	6.2
Other permanent fruits	480	1.1	1 036	3 124	0.5
Associated permanent fruits	615	1.4	5 756	25 347	3.8
Other	1 000	2.3	s/d	s/d	-
Total	43 973	100.0	136 085	661 154	100.0

Source: Estimates based on data from the Seasonal Districts of L. Cardenas, and Petatlan, & the Irrigation District of J.M. Morelos.

Table 25 - Livestock Production in the Conurbation, 1980

Municipality	Cattle	Swine	Sheep	Goats	Horses	Fowl
J. Azueta	20 000	16 000	146	3 300	3 760	49 150
La Union	25 700	15 000	400	4 200	1 600	42 000
Coahuayutla	35 300	17 000	170	2 070	4 200	77 130
Arteaga	33 000	12 000	100	1 400	4 800	36 300
L. Cardenas	11 000	8 700	-	460	1 500	51 000
Region	125 000	68 700	816	11 430	15 860	255 580

Estimates are based on the following sources:

- PIDER, Region 38: Costa Grande de Guerrero. Programa Agropecuario, para. 1979.
- Distrito de Temporal V, SARH: Programa de desarrollo agropecuario en el Municipio de Coahuayutla, 1980.
- CONURBAL: Diagnostico agropecuario de la Zona Conurbada de la Desembocadura del Rio Balsas, 1980.

steel industry and Fertimex. Independent consultants estimate that the industrial waste being discarded there is equivalent to that of a city with a population of 13 million. The iron and steel industry alone discharges 30 tons of nitrogen daily in the form of ammonia, which on reaching the port and nearby coastal area causes eutrophication. In the future Fertimex will be discarding 100 tons of phosphoric acid daily (equivalent to 33 tons of phosphorus) which alone is equivalent to the untreated waste of a city with a population of 13 million.

5. Technology

Throughout the region, the technology in use is archaic. Answers to our questionnaire showed that only 18% of those interviewed used any sort of mechanical device, and another 20% used a combination of animal and mechanical energy. The rest used only animal and human energy, even in areas where the terrain was favourable. All the tractors used were in the coastal area, and half of these were in the Lazaro Cardenas municipality. The use of technology in this subzone will be discussed later on in more detail in the corresponding section.

We mentioned earlier that the average production of maize was around 1.3 tons per hectare. Obviously, the farms that work the land with the same methods as those used in pre-hispanic times will have a much lower yield. In the study done on irrigation district no. 8 it was found that almost 70% of the 192 farmers in Arteaga and Lazaro Cardenas, used these traditional methods, and had yields of less than 800 kgs. per hectare. Most of the farming is done without fertilizers, improved seed, pest control, or mechanization (see Tables 26 and 27). We have already discussed espeque, or stick planting, which results in germination which is erratic at best, and swidden agriculture which consists of felling forests and burning the brush, which makes the land arable for two or three seasons, after which the farmer is obliged to move further into the forest, leaving the land bare and consequently subject to rapid erosion. Illustrative of the situation is coconut, the oldest and most extensive crop in the area, forty per cent of which is left to grow naturally without the attention necessary for improvement or conservation. The rest, particularly plantations situated near the water sources, increase yields through supplementary watering, combining with other fruit trees that bring in a good deal more.

Insignificant capitalization and backwardness in the working methods of most of the small farms, particularly the ejidos, are seen in the type of machinery and work tools used; 30% of the farms have only manual tools; 64% of them own ploughs (half of which are wooden to be pulled by draught animals).

The stony, poor-textured soil imposes additional limitations on the farmer who does not have animals. He may be obliged, for example, to have his land ploughed in exchange for part of his harvest. The most important problems of most of the region are not so much the amount of land available as its quality - it would therefore serve little purpose to increase allotments of land, since the farmers would not have the energy necessary to work larger surfaces of difficult land. The essence of the problem is always technical - a matter of changing the criteria of soil use and the organization of labour. In the mountain region it obviously takes more energy, knowhow, and technology to do productive farming than on naturally endowed lands, and the decisions that must be taken are extreme: one must let the land continue to produce the way it does because it cannot do any better, or one must introduce the much more modern and sophisticated methods that will make the present use of the term 'arable land' obsolete.

6. Ejidos

The development of agro-industrial activities such as fruitgrowing, beekeeping and cattle- and poultry-farming is very recent in the Conurbation. Since the 1970s a number of different enterprises have been initiated - each with different results - and are contributing to change in the productive structure of the region. In 1980 we gathered information on 53 ejidos (19 in La Union, 18 in José Azueta, 11 in Lazaro Cardenas, 3 in Coahuavutla and 2 in Arteaga) which had been granted a total of 85.5 million pesos in credit. Many of the enterprises (37.7% of the total) were cattle farms; the fruitgrowing and fishing businesses comprised 21% and 19% respectively; the remaining 22% comprised beekeeping, poultry-farming, forestry and the manufacture of sombreros. Most of these enterprises were established after 1976, and those we contacted generally stated that they were not working well; of those enterprises that were begun before that year, 80% of the people questioned state that they turned out to be satisfactory. In actual fact, the year of start-up is not the indicator of its failure, which is probably due to the municipality in which it is situated - dissatisfaction was greatest in the municipality of J. Azueta, and satisfaction was greatest in La Union.

Table 26: Yield (in tons/hectares) and use of fertilizer (in hectares) in four municipalities in the Conurbation, 1980

Product	Cultivated surface						Harvested Surface						Yield	
	Fertilized		Not fertilized		Total		With fert.		Without fert.		Total		With fert.	Without fertilizer
	N	%	N	%	N	%	N	%	N	%	N	%		
Zihuatan.														
Corn	596	12.1	4 368	87.9	4 964	100	596	12.3	4 241	87.7	4 837	100	2.2	1.3
Sesame	0	-	200	100	200	100	0	-	132	100	132	100	.8	.6
Sorghum	50	100	0	-	50	100	50	100	0	-	50	100	3.0	2.6
Coahuayutla														
Corn	1 147	15.7	6 155	84.3	7 302	100	1 147	15.7	6 179	84.3	7 326	100	2.2	1.3
Sesame	261	15.4	1 438	84.6	1 699	100	261	15.4	1 438	84.6	1 699	100	.8	.6
Sorghum	-	-	-	-	-	-		-					3.0	2.6
Peanuts	115	16.7	574	83.3	689	100	115	16.7	574	83.3	689	100	1.3	1.2
Beans	0		487	100	487	1000	0		487	100	487	100		.6
	0		250	100	250	100	0		250	100	250	100		
	0	1 000	100	1 000	100		0		1 000	100	1 000	100		
Arteaga & L. Cardenas														
Corn	1 415	25.8	4 078	74.2	5.493	100	117	5.7	1 949	94.3	2 000	100	.4	.2
Sorghum	387	91.1	38	8.9	425	100								
Sesame	-	-	368	100	268	100								
Beans	-	-	30	100	30	100								
Peanut	-	-	60	100	60	100								
Coco	405	14.3	2 431	85.7	2 836	100	405	14.3	2 431	85.7	2 836	100	1.7	1.3
Banana	100	25.0	300	75.0	400	100	100	25.0	300	75.0	400	100	25.0	15.0

Source: SARH, 19

Table 27: Corn production methods in two municipalities in the Conurbation, 1980

Municipality	Production methods	Producers		Cultivated Land		Harvested Surface		Production		Yield
		N	%	N	%	N	%	N	%	TN/HAS
L. CARDENAS	Barbecho(.)	58	25	216	23	216	23	378	41	1 750
	Espeque(..)	173	75	713	77	713	77	534	59	750
	Total	231	100	929	100	929	100	912	100	
ARTEAGA	Barbecho(.)	236	35	2 122	48	1 191	38	1 905	55	1 600
	Espeque(..)	425	65	2 298	52	1 950	62	1 560	45	800
	Total	661	100	4 420	100	3 141	100	3 465	100	
BOTH	Barbecho(.)	294	32	2 338	47	1 407	35	2 283	52	1 622
	Espeque(..)	598	68	3 011	56	2 663	65	1 560	48	786
	Total	892	100	5 349	100	4 070	100	4 377	100	1 075

Source: SARH, 19

(.) Dry farming.
(..) Digging Stick and swidden combined.

The Banco Rural is the organization that has financed most of the ejidos in the area, followed by PIDER (Integrated Programme for Rural Development) and to a much lesser degree by organizations such as Productos Pesqueros Mexicanos, the National Fruitgrowing Commission, the Balsas River Commission, the Ministry for Agriculture and Water Resources, and the now nonexistent Agrarian Reform Foundation. Most of the cattle-farming enterprises were financed by PIDER, most of the fishing enterprises by PROPEMEX. The credit figures obtained from those enterprises that provided information (14) showed that only four of them were given more than 5 million pesos. The cattle-farming enterprises received a little more than half the credit (44,500,000 pesos) and fruit-growers were next with 15,800,000 pesos. It is interesting to note that all these enterprises hired paid workers. However, before going into further detail regarding credit, let us consider one or two other important aspects of the economy.

7. Organization of labour

One of the characteristics that the ejidos have acquired lately has been an increase in the combined use of family and paid labour. When paid labour is combined with mechanization, extension of the cultivated area and integration into a market, we witness a transformation from peasant to capitalist economy characterized by the accumulation of a surplus. In this region, however, this occurs mostly on the coast, and the nature of the combination varies.

Attempts to reform old peasant structures have been encouraged by the increase in agricultural demand and the considerable pressure exerted by government agencies to modernize; but rural employers are at a disadvantage, particularly in competing for labour with the two centres. Thus, labour-saving devices are acquired and personnel hired only during the peak periods in the production process. This feature of the organization of labour leads to a series of contradictory processes: while certain producers conduct their enterprise individually, there are also a great number who sell their whole production (with the fruit still on the trees) to middlemen who have established organizations for harvesting and transporting to avoid having to hire workers at harvest time. The process of capitalization and development is thereby hindered, in that the producer relinquishes a good part of his surplus, and so frustrates the process of accumulation and growth.

In the mountain sub-region, although work continues to be a family affair, ejidos occasionally hire itinerant labour perhaps because of the deterioration in family business as a result of migration of the young, demographic pressure, the impossibility of leaving land to one's children, etc. The sons and daughters of the poorer peasants are obliged to stay in the area and hire out as seasonal labourers.

8. Credit

Some years ago the federal government decided to implement a policy that made a considerable amount of money available for promoting the modernization and capitalization of peasant economies. Through adequate and cheap credit (easy terms) it was aimed to bring about changes in the use of the soil (promoting the incorporation of new crops for commercial use), to increase the production and productivity of the land and labour (by using fertilizers, improved seed, machinery, technical assistance, etc.) and to increase the accumulation capacity of the community plot production through participation in trade, not only in production but also in raw materials. The policy was backed with fixed guarantee prices for the products.

The method chosen consisted in stimulating the use of credit and at the same time imposing a series of conditions as to the use of the same, the form of payment, the terms of the credit, the type of inputs to be employed, the use of technical assistance, etc. Thus, little by little, the Banco de Fomento agency became a super-agency of the state which, while attempting to modify once and for all the ancestral logic behind peasant production, led to the complete subordination of the producers to the modernizing management of the financiers. In the most extreme cases the rigorous and manipulated application of these principles on the part of the bank caused the peasants to lose control of their own production processes. With the need for money already established, in order to obtain the credit to be paid in instalments, the farmer had to respect and obey the instructions of the bank inspector as regards what to sow, how to do so, what raw materials to use, where to buy them, to whom the products should be sold, etc. The bank was the centre for buying and selling. The total value of the production was handed over, the bank retained the total sum of the credit plus interest, and the producer was left with the remaining sum as his profit. The problem was that there was hardly ever any profit: in the best of cases the producer came out even, and in the worst, in debt. The loss of a crop due to drought, floods, pests and other causes is all too frequent and so, therefore, there was delay in payments. The problem with the agrarian reform community plot structure is that there cannot be an embargo because the property is social and not individual. What then happens is that renewed credit is refused. We thence return to the same situation as before. Every once in a while, economic amnesty is granted or there is a release from the debt in order that the farmer may once more become the object of credit. This conduct becomes habitual and is integrated into the memories and habits of the community, leading to the evasion of the economical and technical impositions associated with credit. Regardless of how ingenious a deceit it may be, it can only lead to the reinforcement of these same patterns of conduct that lead to distortion and inefficiency.

As far as the credit agencies are concerned, there is neither the desire, the organization, the co-ordination, the administration nor control of the complex processes that is required to really put the policies advocated into practice. The different stages of the production cycle are extremely strict and demand that seed, fertilizer and money for paying harvesting costs be supplied at precise moments and, if this is not so, the whole process is endangered. The bank is an extremely bureaucratic organization and, according to the statements of most of those interviewed (70%), does not possess the mechanisms that allow the necessary flexibility. Of course, there is also the tradition of corruption and differential social situations that lead to differential social responses. It is the better-off farmers who have greater access to credit and have the contacts within and outside the agrarian reform community that allow them to overcome obstacles and hindrances.

Corruption is rife with the overvaluing of land to obtain higher credit, wrongful withholding of payments, delivery of raw materials different from those specified, etc. In general, the farmer's debt is considerably more than the money and services he receives. This has reached the point where, according to the unofficial accusation of one of Banco Rural's own inspectors, the peasant farmers receive only 20% of the credit assigned to them.

All along the conurban zone, particularly along the coast, about 45% of the farmers received some sort of credit, although the exact amount varies. The areas that received least credit were those in the mountains. As regards the amount of credit received in each case, 63% received small amounts ($4,500 pesos per production unit). At the other extreme a small minority of applicants (2.7% of the total) accounted for 75% of the credit applied for, averaging 1,600,000 pesos per loan.

9. Trade

This system is a complex network of channels between producers and distributors, between producers and government agencies. The characteristics and mechanisms of the system vary with the type of product, the subzone, the system of communications with local or regional markets, the transport systems, etc. But independnently of these factors, trade modalities permit the appropriation of the scant excess produced on the smallholdings by a few monopolists - particularly in the mountains - who control goods and raw materials on the selling level as well as the buying. This comes about because of the ignorance of the small farmers and the ejidos, and their unfamiliarity with the market processes, and has little to do with what they produce.

The trader-transporter-moneylender-monopolist takes advantage not only of the community farmer's inability to profit from using his own resources at the end of each productive cycle, but also of his physical isolation in the mountain regions, his social isolation and lack of experience in commercial transactions. He acquires small individual quantities of production at very low prices, established distributing operations on a scale which includes collection and transportation and often, as we have said, even harvesting of the product. Thanks to the banks and the distributors, the producers have no contact with the market - neither as participants or as spectators in the seasonal game of supply and demand; they neither compare nor decide prices, nor do they have the tools, vehicles or warehouses that would enable them to sell at the best time. Their field of action is either the edge of their property or plot, or the counter of the monopolist in the ejidal community.

As individual producers of riduculously small quantities, disperses in small individual plots and lacking in resources, capital and tools, it is obvious that these community farmers can break the bonds that bind them to the monopolizing traders only if they get together and organize themselves so that collectively they can decide what investments they require. Theoretically the ejido would appear to be the place to start, but at this level internal differences between well-off peasants and poorer ones creates a particular kind of power structure where the co-operative society of the ejido clashes with the interests of the more fortunate peasants who have the power and who are often the trader-monopolist-transporter-moneylenders. The more isolated the plot, the more helpless the farmer.

The federal government agencies charged with correcting these problems (CONASUPO, Impulsora Guerrerense del Cocotero and BANRURAL) not only suffer from the same sclerosis as the other banking institutions, but clash directly with the local tyrants. A typical example was the attempt of the Impulsora Cocotense to monopolize the coconut market and eliminate the middlemen; it tried to impose fines on producers who did not trade with it. Their payments were always late, and the producers finally went back to the moneylenders.

10. Summary

The rural area consists basically of two sub-regions: the coastal region, where seasonal crops have been displaced by permanent plantations, and where tendencies towards a capitalistic agricultural economy are becoming evident; and the mountain region, where the production of maize, sesame, peanuts and beans continues to be the basis of a backward and precarious peasant system of production.

Population increase, overworking of the land and ancestral techniques handed down from generation to generation and unadapted to changing condition and needs, are phenomena that are part of a vicious circle which leads to an ever-increasing degradation of natural resources, a decrease in arable land, and increased erosion of the soil. The mountain regions are those most affected. It is in Coahuayutla that the most extreme conditions exist: a hundred per cent rural, it has about 6,000 inhabitants of economically active age, for only half of whom is there any work at all. Some of the unemployed become sharecroppers; most emigrate. The lowest yield per hectare in the country, impoverished, underemployed and undernourished, the region has little or no chance of overcoming its chronic and endemic problems. Ninety per cent of the population is illiterate. Ignorance here is not just a problem of formal education but involves more basic problems of living and producing. Farmers have only the most rudimentary notions of accommodating crop cultivation to the type of land, or of general environmental characteristics; reading would enable them to understand their own rights and to assess the organization necessary to demand, protect, improve and increase those rights.

We have devoted a chapter to the quantitative and qualitative aspects of education, so we will stress only those general notions that have to do with emergency situations and the various levels of social organizations.

In the area of soil use, the major problems to be faced are

- the rehabilitation of areas eroded by swidden agriculture and excessive grazing,

- increasing the arable area through more rational and productive methods of clearing land that will not lead to erosion,
- increasing productivity through more efficient use of surface and underground water resources,
- the elimination of uneconomically small plots and the curbing of property accumulation, particularly where concentration is not undertaken for the productive utilization of land with high potential,
- increasing the arable surface and productivity through changes in the logic behind production.

It is well known that increased agricultural yield depends on several factors, among which are

- the introduction of new scientific-technological criteria to improve the quality of species, increase production capacity, and accelerate production cycles,
- the utilization, for preparation of the soil, sowing, maintenance and harvesting, of those criterial best adapted to the nature of the soil and of the species that have been introduced,
- the utilization of the compounds necessary to enrich or rehabilitate the soil and to protect the crops from harmful external factors during their period of growth,
- the use of machinery and tools adapted to the physical characteristics of the land, the type of manual labour being carried out, the demands of each stage of the cycle and the overall organization of the work.

All these factors combine to form what are commonly referred to as "technological packages", which have usually been worked out for irrigated areas and commercial-scale agriculture. As far as we know, very little or nothing has been done for these mountain regions. There is also the well-known problem of adapting processes designed for one context to the needs of another which has very different characteristics. Research is necessary in these cases to avoid the isolated introduction of elements that would tend to reproduce the same sort of results that we are analyzing here; hence our insistence on research in the greatest detail that time and space will allow.

In the mountains the area devoted to cattle-farming is larger and shows better prospects. With a few changes that could be achieved almost immediately, production could be improved substantially. Among these charges are suplementary feeding with natural or cultivated pastures and/or animal foodstuffs, the installation of reservoirs to prevent excessive wandering of the livestock, the introduction of health standards for the improvement and maintenance of breeding animals. Pig and poultry farming, which is done along lines similar to those of cattle farming, could follow the same principles.

Apart from the effect of those "packages" for productivity, the overall conditions of production related to the distribution of merchandise, the trading of raw materials and products, and the systems of credit can be combined in many ways to reinforce each other. Most of the ejidal land situated in the mountains is isolated and marginal. Access is on horseback only, over considerable distances along dirt tracks, which are passable only during part of the year, and participation in the game of supply and demand implies communications. The problem of the middlemen and their parasitism, which is a product of the fragmentary nature of peasant production, demands the formation of independent small-producers' co-operative organizations. The same applies to storage; the solution offered by the state does not seem adequate. In the combination of individual habits and power structures, the most powerful, those involved in intermediary or buying-up operations, conspire to reinforce the bureaucratic tendencies of the state organization.

Credit and finance must become more flexible, and the sums lent must be adjusted to the unit being worked. Where credits are too small, the farmer's efforts will be unproductive, and he may be tempted to divert the money to other purposes altogether.

Land tenure and problems of interand intra-ejidal boundaries also require urgent attention. Tension arises with the ingress of squatters, expansionists, borrowers and other figures, who create adverse situations that threaten to disrupt work and order in the ejidos. Delays in official procedures due to extensions, normalization or subdivision of the land also impede the granting of credit and other priority activities, including the activities of the ejidos themselves.

On the coast a considerable area of good uncleared, inadequately worked, or idle land could easily be incorporated into the productive agrarian system. Costly irrigation systems that have been built are not utilized to their full potential, and tendency towards one-crop fruit production at the expense of short-cycle crops, despite short-term economic advantages, may very soon become a serious problem.

The introduction of cattle-farming along the coastal belt, to allow the soil time to recuperate, is an alternative worth considering.

On the coast, labour organization is capitalistic; the economy is production-oriented, credit-based, and in close contact with the markets. Advancement of a predominantly traditional agriculture in this region has been rapid, but the farm production sector is fragile and getting weaker as the urban centres flourish. Inflation, decreasing supplies of manpower and a widening gap between the expanding urban estates and the flat lands have created enormous problems in the effective use of investment in the rural areas and its overbearing influence in the selection of crops.

Fruit-trees do in fact represent a sector of coherent use of investment, although from the planning perspective, there is some lag between the actual and potential use of soil resources in the irrigated zones, and thus complications in food and grain supply and price fluctuations.

The Appendix to this Chapter includes physical descriptions of 13 sub-zones, their types of production, geographical location, usual trading centres, etc.

Chapter 5: POPULATION STRUCTURE AND DYNAMICS

In this chapter we will analyze the historic evolution of the area from 1930 to 1980, and prospects for the coming twenty years, based on three hypotheses formulated by the National Population Council (CONAPO).

The historical evolution of the five counties of the Conurbation will be discussed in detail, with particular attention to the future growth of the Lazaro Cardenas micro-region, which includes fourteen towns (see also the Appendix to this Chapter).

1. Historical evolution 1930-1980, by municipality

In 1947 the municipality of Lazaro Cardenas, referred to as Melchor Ocampo del Balsas until 1970, was formed. Until 1953, when Teniente José Azueta municipality came into being, there were only three other municipalities in the Conurbation: Coahuayutla and La Union in the State of Guyerrero, and Arteaga in the State of Michoacan. Growth in the region as a whole was very slow until the 1960s, and some of the counties suffered net losses through emigration, although by the end of the 1930s the town of Melchor Ocampo del Balsas was attracting some influx as a result of the subdivision of old haciendas under the ejidal system and the fostering of coconut plantations by the government during the term of Lazaro Cardenas as President of Mexico (1934-1940). The establishment of the Rio Balsas Commission in 1960 and the construction of the substantial infrastructure of the dams at El Infiernillo and La Villita, and miles of highways, had a significant effect on migration and population retention. The population of the area as a whole grew to 52,324 (see Table 28); the Teniente José Azueta, one of the two largest counties in the zone, rose to 9,693 (18.52% of the total), Melchor Ocampo to 7,704 (14.72%).

During the period 1960 to 1970 the dramatic impact of the new structures was evident. The rate of population growth for the region as a whole was 57.9%. Lazaro Cardenas county became the most important in the area in terms of population, with 24,319 inhabitants (a rate of growth of 215.67% for the

Table 28: Evolution of the population of the Conurbation by County (1930-1978)

County	Year						1960-1978 Variation %	1970-1978 Variation %
	1930	1940	1950	1960	1970	1978		
Coahuayutia	9 546	9 917	10 381	12 057	10 693	13 715	13.8	28.3
Jose Azueta	-	-	-	9 693	17 873	35 000	261.1	95.8
La Union	14 517	10 814	13 192	10 300	13 234	17 734	72.2	34.0
Arteaga	11 808	14 780	14 383	12 570	16 506	21 219	68.8	28.6
Lazaro Cardenas	-	-	5 045	7 704	24 319	61 088	873.9	151.2
Conurbation	35 871	38 011	43 007	52 324	82 625	148 756	184.3	80.0

Source: The national population censuses for 1930, 1940, 1950, 1960 and 1970 and the census of the Conurbation, 1978, taken by the National Commission for the Eradication of the Paludism.

decade), followed by José Azueta with 17,873 inhabitants (growth rate 84.39%). The growth rate of Arteaga and La Union municipalities was more moderate (31.31% and 28.49%), and Coahuayutla in fact suffered a decrease in population (-12.76%).

Growth was even more dramatic during the following decade, both at the poles and in the neighbouring counties. The greatest impetus to growth came from the completion of the Ixtapa-Zihuatanejo hotel complex, the initiation of operations at the Lazaro Cardenas iron and steel plant, the network of highways that now connected the region to the interior of the country and to the nearby centres of activity (via Acapulco and Arteaga), the building of the J.M. Morelos dam irrigation system, and the proximity of the Zihuatanejo International Airport. Even in the mountain regions the tendency of the population to emigrate diminished during the period between census.

Reliable data regarding the origin of immigrants to the Conurbation does not exist. In a survey of pupils attending primary schools in the Lazaro Cardenas micro-region, which although not represenetative of the population as a whole is nevertheless illustrative, R. Pietri (1978) found that between 1960 and 1970 71% of the parents came from localities within 300 kilometres of the micro-region; 25.5% from more than 300 km but less than 1,000 km away; and 3.5% from areas more than 1,000 km from the micro-region. Half of the families came from what the author denotes as rural areas; 20% from urban areas outside of the micro-region; 3.5% from the Federal District; 20% from localities within the Conurbation where major infrastructure and construction projects had been carried out. Between 1970 and 1975 the places of origin changes somewhat: 57% came from within 300 km; 33% from the intermediate area; 10% from outside a radius of 1,000 km. The proportion of rural immigrants dropped to 33% and that from the Federal District increased to 10%. These changes in place of origin seem to be reflected in changes in the occupational structure of the micro-region. There is a trend away from unskilled rural labourers employed in construction, and towards skilled workers, technicians or professionals coming from urban areas.

Preliminary data from the 1980 National Population Census show that 188,392 people were living in the Conurbation, the majority of them in areas near the centres of development, particularly the micro-region of Lazaro Cardenas. The final figures from the 1980 census for the counties of the Conurbation are not yet available, and population estimates for the various towns vary considrably with the agency doing the calculations. Estimates of four government agencies for the town of Gazaro Cardenas are:

Instituto Vacional de Desarrollo de la Communidad	70 534
Presidential Office	50 350
Lazaro Cardenas Trusteeship	90 339
PALUDISM Commission (1978)	48 004

The data from the National Commission for the Eradication of Paludism, which we consider the most reliable source, shows that the period from 1970 to 1978 gave rise to an explosive population growth at the poles (151.2% in Lazaro Cardenas county and 95.8% in Teniente José Azueta). Growth was also accelerated in other counties as well - 34.0% in La Union, 28.6% in Arteaga, and 28.3% in Coahuayutla. The growth rate throughout the Conurbation was 80.0%.

i) Urbanization

Until 1970 the distribution of the population in the five counties that consititute the zone was fairly well balanced. From that moment on we observe an increasing tendency to grow at the poles, upsetting the equilibrium and leading to concentration on the coast, particularly in the Lazaro Cardenas micro-region.

Prior to 1960 there had been no town in the Conurbation with more than 5,000 inhabitants. By 1970 24.04% of the population lived in towns of more than 5,000 inhabitants and 11.64% in towns of over 10,000. This trend was to increase even more by 1980, reaching the national averages for urbanization and overtaking those of the two States constituting the micro-region - Guerrero and Michoacan - the two urban system corresponding to the centres of development at José Azueta and Lazaro Cardenas. Although urbanization has been in progress for the past twenty-five years, these two systems fit perfectly into the new national decentralization policy, particularly Lazaro Cardenas, where decentralization through concentration takes place in accordance with the programme for the formation of industrial ports, an attempt to solve simultaneously the problems of high population concentrations on the alteplano and in a few cities, and of the great number of people that live in very small isolated towns.

The growth of the Ixtapa-Zihuatanejo tourist centre is not as explosive as that of Lazaro Cardenas; its present population is approximately 40,000. Its slower growth is probably due to the fact that it is a tourist town and has been more careful to preserve its urban character, especially in the central area. Its appearance is that of an orderly, clean city. It is a city devoted to the service of its visitors, but it has a lived-in atmoshphere; it is not a 'dormitory town'. It has many green areas and is not overwhelmed by pavement rubbish as Lazaro Cardenas is.

Despite the urban planning programmes that have been in effect since the 1960s, the impression that Lazaro Cardenas gives is certainly not that of an orderly city. It follows the same processes of secular development that make Mexico's cities 'traditional' - uses urban space, with a plaza or square at the centre or confluence of urban activities, wide avenues, drainage systems, and paved streets - but Lazaro Cardenas lacks order, especially social. On one hand, there are fairly modern housing complexes (some of which remain uninhabited because they are so costly) and wholesale and retail merchants all thrown together along the main street and some of the side streets. In contrast there are unauthorized settlements without even the most elementary conveniences. The drinking water is not safe to drink (1); rubbish collection is deficient if not non-existent and the rubbish is thrown into the streets, alleys, vacant lots, gulleys and nearby riverbeds.

But Lazaro Cardenas continues to mushroom. Urbanization was initiated in the micro-region with the formation of the Balsas Commission, and the building of La Villita dam and the network of roads attracted mainly construction workers and other unskilled labourers, most of whom settled in Guacamayas (which grew from 271 inhabitants in 1960 to 4,136 in 1965) in sub-standard housing and later in workers' camps. The most intensive migration began in the 1970s with the construction of the iron and steel plant and other major works. Large Mexican and foreign construction companies, technicians and specialists, skilled and unskilled workers and peasants came to the region. SITTSA and INDECO, which had already formulated urban planning programmes, began work on the 965 hectares on which the Lazaro Cardenas Trusteeship was to be built. Plans for urban development, communication networks and housing prototypes were formulated. Two hundred and sixty-eight hectares were urbanized, almost 2,000 dwellings and 55 commercial premises were built, and 2,000 urban plots were made available. Drinkingwater, drainage, and stormwater systems were built. Siderurgico Lazaro Cardenas Las Truchas, S.A. built camps at La Orilla and La Mira, urbanizing and building some 1,600 houses for their middle- and higher-level personnel. These camps were not incorporated into the city complex but operated as a kind of satellite city with all

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(1) Laurelli, 1982, states that drinking-water wells have been drilled without proper precautions, and the aquifers have been contaminated by contact with cesspools.

Table 29: Urbanization in the Guerrero/Michoacan area, 1950-1980

City size (by number of inhabitants)	1950		1960		1970		1980	
	Population	%	Population	%	Population	%	Population	%
National level								
5,000- 9,999	9 139 087	34.65	15 158 073	42.22	25 032 387	50.13	38 834 264	56.00
10,000-19,999	7 633 050	28.94	12 723 878	35.44	21 167 461	42.33	32 981 385	47.56
20,000 and over	6 345 929	24.06	10 641 527	29.64	17 607 061	32.26	27 364 286	39.46
States of Guerrero & Mich.								
5,000- 9,999	440 803	18.13	759 871	23.92	1 308 719	31.65	2 142 175	39.87
10,000-19,999	295 165	12.14	517 805	16.30	996 115	24.09	1 820 876	33.89
20,000 and over	151 959	6.25	368 817	11.61	853 045	20.63	1 625 840	30.26
Conurbation								
5,000- 9,999	0	0	0	0	21 166	24.04	103 785	55.09
10,000-19,999	0	0	0	0	10 246	11.64	87 696	46.55
20,000 and over	0	0	0	0	0	0	68 806	36.52
LC Microregion								
5,000- 9,999	0	0	0	0	15 842	78.67	74 542	92.28
10,000-19,999	0	0	0	0	10 246	50.88	68 806	85.18
20,000 and over	0	0	0	0	0	0	68 806	85.18

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its own services. Three camps were built for single male workers within the plant, inhabited at one time by 9,000 people.

INFONAVIT (the National Housing Institute) build what was known as the "six hundred houses" which for quite some time were not in great demand. The project was suspended, and the buildings are now fitted out for low-cost housing. A subsequent project in a neighbouring zone, known as the "one thousand five hundred houses", comported a number of important changes. Other governmnt agencies installed facilities: the Mexican Social Security Institute built a medical clinic (T1); the Instituto de Seguridad Social al Servicio de las Trabajadores del Estado, a Clinic for State Workers; Compania Nacional de Subsistencias Populares, urban and rural networks of stores; the Comito Administrador del Programma Federal de Construccion de Escuelas, schools; the Mexican Telephone Company, its network, etc.

In 1979, once the 1977 to 1978 depression (due to the withdrawal of investment) and the consequent unemployment and emigration was over, the oil boom began once again to attract investment. In January 1981 the second phase of the iron and steel plant, planned for 1977 and postponed until 1980, was actually begun. The Industrial Ports Programme was initiated in 1979, an the De la Palma, El Cayacal and Enmedio Islands were expropriated for an industrial project covering 1,262 hectares for general and 481 hectares for specific purposes. The 3,683 hectares of wetlands were subjected to urbanization processes which included land levelling, the installation of industrial and domestic water supply, drainage and electricity and the building of roads, port installations and industries.

None of the plans for establishing a city or satisfying the need for dwellings was adequate. The demand continually exceeded the supply (except in times of depression) and those left without shelter were relegated to rented rooms in Lazaro Cardenas or nearby areas. The peasant style of life was introduced into the urban very poor zones, where animals inhabited the dwellings with the people.

Apart from beautiful beaches (endangered by growing urban and industrial waste) the city had nothing to offer its growing population, and the typical pastime was to "go and get drunk somewhere". In short, the extremely high rate of growth was the product of human migration towards the towns nearest the big construction works - Lazaro Cardenas-Guacamayas-La Mira on one hand, and Zihuatenejo-Agua de Correa on the other - and together with increasing urbanization, it continued. The towns most affected were the municipal capitals, with the exception of Coahuayutla, and a migratory process from the interior and from other areas of the country began in a kind of "march to the sea". For the Conurbation this meant higher concentrations of inhabitants in the now-urban towns, and a decrease in the number of inhabitants in the mountain regions. However, the term urban is relative, for although 90% of the population was living in towns of more than 5,000 inhabitants (and 85% in towns of more than 10,000), it was only in the centres such as Lazaro Cardenas and Zihuatanejo that such facilities as drainage, water supply, paved streets, communication and postal systems, etc., existed. Many of the neighbouring towns that grew very rapidly lacked even the barest facilities and such growth could very well be described as anarchic.

If present trends continue, urban and industrial expansion and the concentration of population in the coastal region will deprive the area of its best farm lands.

ii) Composition of the economically active population (EAP)

The intense secondarization and tertiarization of the economy over the past thirty years were concentrated mainly in the towns near the areas of development. In 1950 almost 90% of the population of the Conurbation was involved in its primary economic sector; by 1980 the figure was 51.93%. The secondary and tertiary sectors that in 1950 had involved a fraction of the population (4,33% and 6.39%) grew rapidly in the intra-census periods, particularly after 1970, when they doubled their activity. The trend persisted in 1980, when the secondary sector employed 21.2% of the EAP and the tertiary sector 26.84% (see Tables 30 and 31).

Between 1970 and 1980 changes were great, and in the Lazaro Cardenas, La Union and José Azueta municipalities, the tree sectors of the economy acquired virtually the same importance, as the tertiary sector grew more and more rapidly.

The county of Lazaro Cardenas - now the centre of industrial activity in the Conurbation and the county for which the most and best information is available - had in 1970 a population 12 years and older of 13,935 (57% of its total population), made up of 6,547 females and 7,388 males. Of this population, 6,200 were economically active and 6,128 had employment (99.84%). The inactive population was composed of 7,735 persons (68.65% in household and 17.78% as students). Most of the inactive population was female (84.62% of the total vs. 29.71% for the males). The rate of participation of the populations as a whole was one of 44.5% (15.38% female and 70.29% male).

Calculations of the Economically Active Population in 1977-1978 were established by FIDELAC (Lazaro Cardenas Trust Company) for the micro-region. The data show that the EAP grew

Table 30: Economically active population by sector of the economy 1950-1980

Sector	1950		1960		1970		1980	
	Population	%	Population	%	Population	%	Population	%
National Level								
Total EAP	8 288 841	100.00	11 274 181	100.00	13 049 994	100.00	20 632 400	100.00
-Primary	5 050 391	60.93	6 141 046	54.47	5 456 202	41.81	8 149 798	39.50
-Secondary	1 380 921	16.66	2 161 261	19.17	3 178 979	24.36	5 570 748	27.00
-Tertiary	1 857 529	22.41	2 971 874	26.36	4 414 813	33.83	6 911 854	33.50
Guerrero & Michoacan								
Total EAP	723 891	100.00	942 977	100.00	930 264	100.00	1 525 024	100.00
-Primary	565 286	78.09	942 977	100.00	930 264	100.00	1 525 024	100.00
-Secondary	70 073	9.68	85 057	9.02	131 725	14.16	312 873	20.52
-Tertiary	88 532	12.23	131 922	13.99	193 309	20.78	395 906	25.96
Conurbation								
Total EAP	13 567	100.00	17 776	100.00	19 575	100.00	53 375	100.00
-Primary	12 113	89.28	17 776	100.00	19 575	100.00	53 375	100.00
-Secondary	587	4.33	947	5.33	2 345	11.98	11 331	21.23
-Tertiary	867	6.39	1 550	8.72	2 885	14.74	14 324	26.84
Microregion								
Lazaro Cardenas								

Source: National Population Commission.

Table 31 - Evolution of the economically active population in the Conurbation by county (1930-1970)

County	1930	1940	Year 1950	1960	1970	1960-1970 Variations
Coahuayutla	3 034	2 985	3 192	4 654	2 384	- 48.8%
José Azueta	-	-	-	3 579	4 462	+ 24.7%
La Union	4 616	3 226	4 089	3 044	2 979	- 2.1%
Arteaga	3 933	4 535	4 356	4 426	3 314	- 25.1%
Lazaro Cardenas	-	-	1 591	2 657	6 199	+ 133.3%

Source: Population Censuses 1930, 1940, 1950, 1960 and 1970.

considerably to include about 50% of the total, mostly male, population; the participation of the female population diminished as compared to 1970. In the inactive population, the household and student categories both grew, especially in the male population, that more than doubled its participation (90% of the non-active males were studying in the census as compared to the 40% that were studying in 1970 (see Table 32)).

iii) Composition by age and sex

The data from Table 33 on the conurbation and Table 34 on the Lazaro Cardenas micro-region, which were taken by the National Population Council (CONAPO) from the National Population Census, are for 1950, 1960, 1970 and 1980, and are interesting in that they permit the determination of populational pyramids and hence the estimated demand for education and the assessment of the structural characteristics of the population.

The following observations are noteworthy:

Sex: In the various censuses the male population is greater than the female population in proportions that are considerably higher than the national average. It is interesting that we are not dealing with adult males who migrate without their families, for the most noticeable differences in proportion are to be found in youngsters under the age of fifteen - 2.0%:6.3% for the region as a whole and 0.75%: 6.3% for the micro-region. It should also be noted that these differences were greatest in the censuses of 1970 and 1980. In Table 35 the data for 1980 are compared with the national averages and with those of the states of Michoacan and Guerreros.

Age pyramid: In an area where migration is so important, especially among construction workers, the imbalance between the sexes under the age of fifteen is surprising. Provisional data for the 1980 National Population Census indicate that the national figures for the sector of the population under 15 are already high, at 43.92% of the population. For the Conurbation the figure increases to 48.29%, and for the micro-region it is 48.92%. The historical tendency towards a preponderantly juvenile population reached its peak in 1970, and diminished slightly in 1980 to the 1960 level in the Conurbation and to the 1950 level in the micro-region.

We calculated the percentages of the 20 to 59 age-group for 1980 and compared them once more with the national figures, only to find a logically compensating imbalance; the

Table 32 - Lazaro Cardenas microregion: economically active and inactive population (12 years of age and older), by Sex. Fidelac Census of the microregion 1977

Sex	Population 12 Years and Older	Economically Active Population		Economically Inactive Population								Non-specified	
				Household		Student		Other		Total			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Female	10 586	1 380	13.40	7 878	85.61	1 301	14.14	23	0.25	9 202	86.93	4	0.04
Male	11 194	9 391	83.89	125	6.93	1 614	89.52	64	3.55	1 803	16.11	-	-
Total	21 780	10 771	49.45	8 003	72.72	2 915	26.48	83	0.75	11 005	50.53	4	0.02

Source: FIDELAC.

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Table 33: Population of the Conurbation by Age, 1950-1980*

Age-Group	1950		1960		1970		1980	
	Male	Female	Male	Female	Male	Female	Male	Female
0- 4	4 188 (9.19)	3 745 (8.22)	5 957 (10.86)	5 354 (9.76)	10 200 (11.59)	8 861 (10.07)	17 669 (9.38)	15 261 (8.10)
5- 9	3 645 (8.00)	3 326 (7.30)	4 548 (8.29)	4 208 (7.67)	8 117 (9.22)	6 935 (7.88)	15 942 (8.46)	14 226 (7.55)
10-14	3 392 (7.45)	2 855 (6.27)	3 812 (6.95)	3 366 (6.14)	6 590 (7.49)	5 496 (6.24)	15 219 (8.08)	12 664 (6.72)
15-19	2 028 (4.45)	2 452 (5.38)	2 704 (4.93)	2 674 (4.88)	4 378 (4.97)	4 095 (4.65)	10 869 (5.82)	10 018 (5.32)
20-24	1 852 (4.07)	2 006 (4.40)	2 127 (3.88)	2 145 (3.91)	3 229 (3.67)	3 388 (3.85)	8 422 (4.47)	7 836 (4.16)
25-29	1 726 (3.79)	1 872 (4.11)	1 757 (3.20)	1 839 (3.35)	2 752 (3.13)	2 729 (3.10)	6 028 (3.20)	5 480 (2.91)
30-34	1 228 (2.70)	1 375 (3.02)	1 426 (2.60)	1 444 (2.63)	2 064 (2.34)	1 953 (2.21)	4 870 (2.59)	4 552 (2.41)
35-39	1 289 (2.83)	1 276 (2.80)	1 325 (2.42)	1 343 (2.45)	2 028 (2.30)	2 026 (2.30)	4 466 (2.37)	4 558 (2.42)
40-44	960 (2.11)	1 044 (2.29)	1 028 (1.87)	1 107 (2.02)	1 609 (1.83)	1 594 (1.18)	3 781 (2.01)	3 912 (2.07)
45-49	724 (1.59)	633 (1.39)	820 (1.50)	736 (1.34)	1 326 (1.51)	1 140 (1.29)	3 170 (1.68)	3 152 (1.67)
50-54	696 (1.53)	662 (1.45)	815 (1.49)	727 (1.33)	1 079 (1.23)	944 (1.07)	2 487 (1.32)	2 325 (1.23)
55-59	356 (0.78)	261 (0.57)	464 (0.85)	408 (0.74)	687 (0.78)	581 (0.66)	1 744 (0.93)	1 438 (0.76)
60-64	429 (0.94)	386 (0.85)	590 (1.07)	497 (0.91)	811 (0.92)	714 (0.81)	1 339 (0.71)	1 088 (0.58)
65-69	189 (0.41)	167 (0.37)	244 (0.44)	200 (0.37)	305 (0.57)	359 (0.41)	1 167 (0.62)	1 061 (0.56)
70-74	176 (0.39)	175 (0.38)	262 (0.48)	212 (0.39)	448 (0.51)	383 (0.44)	878 (0.47)	814 (0.43)
75-79	70 (0.15)	85 (0.19)	126 (0.23)	107 (0.19)	189 (0.21)	172 (0.20)	558 (0.30)	458 (0.24)
80-84	104 (0.23)	89 (0.20)	90 (0.16)	114 (0.21)	179 (0.20)	166 (0.19)	295 (0.16)	284 (0.15)
85 and older	57 (0.12)	36 (0.08)	146 (0.27)	121 (0.22)	146 (0.16)	163 (0.19)	150 (0.08)	131 (0.07)
Total	23 109 (50.73)	22 445 (49.27)	28 241 (51.49)	26 602 (48.51)	46 337 (52.63)	41 699 (47.37)	99 154 (52.65)	89 338 (47.35)

Source: CONASUPO, 1982.

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Table 34: Population of the Microregion by Sex and Age 1950-1980*

Age-Group	1950		1960		1970		1980	
	Male	Female	Male	Female	Male	Female	Male	Female
0- 4	394 (9.45)	401 (9.62)	808 (11.71)	692 (10.03)	2 394 (11.91)	2 079 (10.32)	7 881 (9.76)	6 431 (7.96)
5- 9	321 (7.70)	317 (7.60)	607 (8.80)	589 (8.54)	1 914 (9.50)	1 548 (7.69)	7 094 (8.78)	6 006 (7.44)
10-14	280 (7.72)	253 (6.07)	461 (6.68)	435 (6.31)	1 530 (7.60)	1 187 (5.89)	6.70 (8.39)	5 328 (6.60)
15-19	172 (4.13)	246 (5.90)	339 (4.91)	334 (4.84)	1 023 (5.08)	924 (4.59)	4 882 (6.04)	4 210 (5.22)
20-24	170 (4.08)	199 (4.77)	258 (3.74)	246 (3.57)	766 (3.80)	798 (3.96)	3 736 (4.63)	3 283 (4.06)
25-29	166 (3.98)	162 (3.89)	206 (2.99)	227 (3.29)	651 (3.23)	633 (3.14)	2 660 (3.29)	2 287 (2.83)
30-34	105 (2.52)	134 (3.21)	184 (2.67)	178 (2.58)	487 (2.42)	403 (2.00)	2 140 (2.65)	1 888 (2.34)
35-39	110 (2.64)	112 (2.69)	164 (2.38)	167 (2.42)	480 (2.38)	475 (2.36)	1 964 (2.43)	1 893 (2.35)
40-44	89 (2.13)	100 (2.40)	137 (1.98)	133 (1.93)	398 (1.98)	360 (1.79)	1 654 (2.05)	1 618 (2.00)
45-49	62 (1.49)	54 (1.30)	100 (1.45)	91 (1.32)	309 (1.53)	266 (1.32)	1 382. (1.71)	1 288 (1.60)
50-54	59 (1.42)	63 (1.51)	114 (1.65)	85 (1.23)	249 (1.24)	196 (0.97)	1 069 (1.32)	943 (1.17)
55-59	25 (0.60)	21 (0.50)	39 (0.57)	43 (0.62)	168 (0.83)	118 (0.59)	733 (0.91)	572 (0.71)
60-64	40 (0.96)	31 (0.74)	71 (1.03)	60 (0.87)	160 (0.79)	136 (0.68)	549 (0.68)	422 (0.52)
65-69	14 (0.34)	12 (0.29)	19 (0.28)	16 (0.23)	95 (0.47)	64 (0.32)	474 (0.59)	408 (0.50)
70-74	13 (0.31)	15 (0.36)	33 (0.48)	15 (0.22)	88 (0.44)	64 (0.32)	349 (0.43)	305 (0.38)
75-79	5 (0.12)	5 (0.12)	7 (0.10)	6 (0.09)	30 (0.15)	28 (0.14)	199 (0.25)	155 (0.19)
80-84	5 (0.12)	9 (0.22)	10 (0.14)	11 (0.16)	28 (0.14)	28 (0.14)	87 (0.11)	80 (0.08)
85 and older	2 (0.05)	3 (0.07)	8 (0.13)	4 (0.06)	29 (0.14)	31 (0.15)	16 (0.02)	12 (0.01)
Total	2 032 (48.74)	2 137 (51.26)	3 566 (51.69)	3 332 (48.31)	10 799 (53.63)	9 338 (46.37)	43 649 (54.04)	37 129 (45.96)

Source: CONASUPO, 1982.

Table 35 - Population under age 15 by sex and by region, 1980

Age Group	National		Michoacan		Guerrero		Conurbation		Microregion	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
0-4	50.19	49.81	50.75	49.25	49.07	50.93	53.66	46.34	55.07	44.93
5-9	50.57	49.43	50.69	49.31	49.19	50.81	52.84	47.16	54.15	45.85
10-14	50.43	49.57	50.87	49.13	52.67	47.33	54.58	45.42	56.00	44.00

Conurbation and the micro-region were considerably lower than the national and the two states' (in which the municipalities are located) averages (see Table 36).

2. Medium-term prospects (1985-2000)

Special studies carried out by CONAPO (1982) estimated population figures for the Lazaro Cardenas micro-region and the conurbation on the basis of three hypotheses:

- the 'historical' or 'tendential' hypothesis, which presumes that changes in natural and social growth occur independently of government policy concerning industrialization, demographic growth and regional development;
- the 'programmatic' hypothesis, which takes into account the slowing-down of growth and changes in existing migration patterns;
- the 'industrial port' hypothesis, which includes in its calculations the future investment and the immigration attracted by job availability.

Our calculations for the conurbation and the micro-region (1) from the three hypotheses are shown in Table 37.

Apart from the impressive population foreseen in the conurbation and the micro-region, the first observation to be drawn from these forecasts is that from the industrial port point of view, 94% of the population will be concentrated in the conurbation, whereas according to the other two estimates the figure will be 75%.

To speak of three different points of view regarding the population characteristics of the conurbation or micro-region is somewhat complicated, because strictly speaking one cannot talk about an historic point of view. The history of the conurbation is too short to justify mediumand long-term forecasts. It is true that the infant mortality rate has diminished, and life expectancy increased; the land is more productive and the urban sector has begun to create new activities, but all these put together can hardly explain the very high rates of growth registered in the past twenty years. This growth is clearly the result of the investments that have

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(1) The towns in the micro-region are (in the county of La Union, Guerrero): El Naranjito, Petacalco, San Francisco, Tamacuas and Zacatula; (in the county of Lazaro Cardenas, Michoacan): Acapican de Morelos, El Bordonal, Buenos Aires, Guacamayas, La Mira, La Orilla, Playa Azul, Campamento Obrero and Lazaro Cardenas.

Table 36 - Population aged 20-59 by region, 1980 (in percentages)

Age Group	National	Michoacan	Guerrero	Conurbation	Microregion
20-24	9.18	8.84	8.56	8.63	8.69
25-29	6.97	6.04	6.25	6.11	6.12
30-34	5.69	5.02	5.35	5.00	4.99
35-39	5.03	4.66	5.42	4.79	4.78
40-44	4.19	4.12	4.18	4.08	4.05
45-49	3.51	3.38	3.44	3.35	3.31
50-54	2.84	2.94	2.73	2.55	2.49
55-59	2.21	1.76	1.97	1.69	1.62
20-59	39.68	36.76	37.90	36.20	36.05

Table 37 - Population data 1950-1980 and hypotheses 1990 and 2000 (in thousands of inhabitants)

Reference Area	1950	1960	1970	1980	Hist. 1990	Hypoth 2000	Progr. 1990	Hyp. 2000	Port 1990	Hypoth 2000
Conurbation	46	55	88	188	346	547	348	547	680	1 671
L.C. Micro-region	4	7	20	81	228	409	230	410	591	1 567

been made here. If the rate of investment slows down or actually comes to a halt, the effect will be noticed immediately. Thus, the 'industrial port' estimates depend not only on continued investment, but on a much more optimistic presumption that the conditions leading to economies of scale and growth mechanisms similar to those of the industrial ports of highly developed regions will be forthcoming. Given the present and short-term situation as regards investment programmes and the country's general economic trends, these presumptions would appear to be unrealistic. It may in fact be necessary to formulate a fourth hypothesis, which would assume growth but be much less bold; growth would be expected five or ten years later, especially in the micro-region.

Owing to the detailed nature of the observations, however, we have gained valuable insights into the future population for which education will have to be provided, and the necessary details of the economic structure for calculating the EAP.

i) Total population

The hypotheses concerning annual rates of growth and the calculations of national, conurbation and micro-region population differ in several aspects, although for the conurbation and the micro-region the historic and programmatic points of view tend to be similar, as shown in Table 38.

Population figures based on the above growth rates are as shown in Table 39.

The industrial port hypothesis predicts that for the year 2000 there will be 1,500,000 people in the 250 square kilometres of the micro-region - a density of 6,500 inhabitants per square kilometre (higher than that of Hong Kong or Mexico City today). Such a rate of growth would imply an extension of the surface of what is now referred to as the micro-region to include more than the 14 towns mentioned in the report, probably along the coast towards Las Penas.

The more conservative calculations of the programmatic and historic hypotheses forecast very large populations in both the conurbation and the micro-region. The growth of a city of 400,000 over the next seventeen years, although impressive, would seem to be more realistic than that of a city four times the size.

ii) Structure of the Population

Sex and age: having divided the population into five-year age groups, the predictions concerning the

Table 38 - Total population hypotheses 1985-2000 (in percentages)

		Annual Rate of Growth			
		1985-1990	1990-1995	1995-2000	1985-2000
NATIONAL	Historic Hypothesis	3.13	3.25	3.23	3.20
	Programmatic Hypothesis	1.91	1.60	1.44	1.65
	Ind. Port Hypothesis	1.91	1.60	1.44	1.65
CONURB.	Historic Hypothesis	5.60	5.15	4.24	5.00
	Programmatic Hypothesis	5.65	5.05	4.19	4.96
	Ind. Port Hypothesis	14.26	10.72	8.10	10.99
MICRO REGION	Historic Hypothesis	8.92	6.78	5.31	6.99
	Programmatic Hypothesis	8.97	6.67	5.26	6.95
	Ind. Port Hypothesis	17.59	11.86	8.65	12.64

Source: CONAPO, 1983.

Table 39 - Total population hypotheses, 1985-2000

		Total Population (in thousands)			
		1985	1990	1995	2000
NATIONAL	Historic Hypothesis	79 979	93 318	109 483	128 356
	Programmatic Hypothesis	78 248	86 019	93 121	100 041
	Ind. Port Hypothesis	78 248	86 019	93 121	100 041
CONURB.	Historic Hypothesis	263	346	445	547
	Programmatic Hypothesis	265	348	446	547
	Ind. Port Hypothesis	349	680	1 132	1 671
MICRO REGION	Historic Hypothesis	149	228	316	409
	Programmatic Hypothesis	149	230	317	410
	Ind. Port Hypothesis	263	591	1 035	1 567

Source: CONAPO, EDPI Project, 1982 (see footnote on p. 176).

configuration of the population pyramid varied with the hypothesis used. The programmatic hypothesis predicts a decrease in the birth rate, with the subsequent predominance of older people. The proportion of children under the age of fifteen would fall to 40.61% by 1985, to 36.94% by 1990, to 34.33% by 1995 and to 32.15% by the year 2000. The industrial port hypothesis is even more extreme; the current proportions of 48.29% and 48.92% in the conurbation and the micro-region are expected to decrease to 35.77% and 30.88%, respectively. Drastic changes are assumed, not only in the birth rate but also in migratory tendencies towards the port.

The historic hypothesis, on the other hand, predicts a growing proportion of younger members of the population in both the conurbation and the micro-region, with the one-to-fourteen-year sector accounting for 44.17% and 44.56% of these populations in the year 2000. These data are to be found in Tables 40 to 45.

Urbanization: in the near future, urbanization in the conurbation and micro-region will be intensive - much higher than the national and regional averages. All three hypotheses state that in the conurbation and micro-region 97% of the population will be in towns of over 20,000 by the year 2000. The industrial-port hypothesis calculates that this percentage will be reached by 1985, while the historic and programmatic hypotheses for 1985 are 85% (see Tables 46, 47 and 48).

For the conurbation and the micro-region a number of differences exist between estmates based on the three hypotheses:

- The industrial port hypothesis that expects concentration of the population in the micro-region, forecasts that it will be early and intensive, and that by 1985 84% will have settled in towns of more than 5,000 inhabitants. By 1990 the figure will have increased to 94.44%, and to 97% by 1995 and the year 2000. According to this hypothesis, 93.77% of the inhabitants of the conurbation as a whole will have settled in towns of more than 20,000 inhabitants.
- The programmatic hypothesis, which coincides with the historic until the year 1990, maintains that in towns of 20,000 inhabitants or more the rate of concentration will be 54.59% for 1985 and will rise gradually to 65.05% in 1990, 75.3% in 1995 and 82.69% in the year 2000. Although the tendency is towards population concentrations in the micro-region, there is also room for expansion at the other pole (Ixtapa-Zihuatanejo) and for natural growth in other towns on the coast or in the mountains.

Table 40: Estimated Population in the Conurbation by Age-Groups, 1985-2000*
(Historical hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	35 015	13.30	58 798	17.01	81 578	18.36	99 977	18.27
5- 9	34 342	13.04	35 792	10.35	59 057	13.28	81 054	14.81
10-14	36 910	14.02	38 783	11.21	39 459	8.87	60 669	11.09
15-19	36 722	13.95	42 732	12.36	43 593	9.80	41 721	7.63
20-24	30 185	11.47	42 700	12.35	47 636	10.72	45 846	8.38
25-29	24 103	9.15	35 228	10.19	46 739	10.52	49 535	9.06
30-34	15 010	5.70	26 223	7.58	36 824	8.29	47 197	8.63
35-39	10 898	4.14	15 855	4.58	26 724	6.01	36 738	6.71
40-44	9 745	3.71	11 285	3.26	16 056	3.62	26 484	4.84
45-49	8 117	3.08	9 913	2.87	11 356	2.55	15 844	2.90
50-54	6 573	2.50	8 166	2.36	9 860	2.22	11 123	2.03
55-59	4 969	1.88	6 519	1.88	8 007	1.80	9 431	1.73
60-64	3 298	1.25	4 848	1.41	6 269	1.41	7 459	1.36
65-69	2 474	0.94	3 157	0.91	4 531	1.02	5 626	1.03
70-74	2 141	0.82	2 271	0.66	2 834	0.63	3 844	0.71
75-79	1 508	0.58	1 807	0.53	1 896	0.43	2 217	0.40
80 and over	1 261	0.47	1 697	0.49	2 099	0.47	2 326	0.42
Total	263 271	100.00	345 774	100.00	444 518	100.00	547 091	100.00

Source: CONAPO, 1982.

Table 41: Estimated Population in the Conurbation by Age-Groups, 1985-2000*
(Programmatic hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	36 157	13.67	51 193	14.69	55 451	12.44	58 057	10.61
5- 9	34 358	12.98	37 324	10.72	52 720	11.83	57 188	10.44
10-14	36 960	13.96	40 163	11.53	44 821	10.06	60 737	11.10
15-19	36 789	13.90	44 556	12.79	49 954	11.21	53 350	10.11
20-24	30 254	11.43	44 616	12.81	54 645	12.26	60 808	11.11
25-29	24 161	9.13	36 882	10.59	53 093	11.92	63 911	11.68
30-34	15 037	5.68	27 006	7.75	40 497	9.08	56 868	10.39
35-39	10 911	4.12	16 208	4.66	28 414	6.37	41 884	7.65
40-44	9 752	3.69	11 481	3.30	16 920	3.79	29 005	5.30
45-49	8 122	3.06	10 049	2.89	11 910	2.67	17 291	3.16
50-54	6 576	2.48	8 274	2.37	10 280	2.31	12 139	2.22
55-59	4 972	1.88	6 603	1.90	8 343	1.87	10 213	1.87
60-64	3 300	1.25	4 923	1.41	6 548	1.47	8 101	1.48
65-69	2 476	0.93	3 222	0.92	4 776	1.07	6 168	1.13
70-74	2 144	0.80	2 326	0.67	3 039	0.68	4 297	0.78
75-79	1 509	0.57	1 848	0.52	2 049	0.46	2 555	0.47
80 and over	1 265	0.47	1 744	0.48	2 275	0.51	2 725	0.55
Total	264 741	100.00	348 418	100.00	445 735	100.00	547 297	100.00

Source: CONAPO, 1982.

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Table 42: Estimated Population in the Conurbation by Age-Groups, 1985-2000*
(Industrial-Port Hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	36 727	10.51	76 164	11.21	126 985	11.21	178 457	10.68
5- 9	38 273	10.95	48 305	7.11	90 756	8.02	143 089	8.57
10-14	50 002	14.31	78 768	11.58	100 534	8.88	149 643	8.96
15-19	53 740	15.38	102 653	15.09	146 604	12.95	177 177	10.60
20-24	47 924	13.72	108 465	15.94	173 025	15.29	226 015	13.53
25-29	39 308	11.25	94 671	13.91	168 336	14.87	240 914	14.42
30-34	21 969	6.29	60 389	8.87	121 357	10.72	197 925	11.85
35-39	14 036	4.02	31 336	4.60	71 994	6.36	133 795	8.01
40-44	11 515	3.29	19 228	2.82	37 793	3.34	78 670	4.71
45-49	9 359	2.68	15 050	2.21	23 696	2.10	42 486	2.54
50-54	7 559	2.16	12 080	1.78	18 478	1.63	27 375	1.64
55-59	5 761	1.65	9 639	1.41	14 676	1.29	12 051	1.26
60-64	3 983	1.14	7 472	1.10	11 718	1.04	16 596	0.99
65-69	3 079	0.88	5 436	0.79	9 131	0.80	13 093	0.78
70-74	2 652	0.76	4 190	0.61	6 673	0.59	9 911	0.59
75-79	1 877	0.53	3 228	0.48	4 790	0.43	6 772	0.41
80 and over	1 691	0.48	3 335	0.49	5 441	0.48	6 789	0.46
Total	349 455	100.00	680 409	100.00	1 131 987	100.00	1 670 758	100.00

Source: CONAPO, 1982.

Table 43: Estimated Population in the Microregion, 1985-2000*
(Historical hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	16 545	11.16	38 796	17.05	61 315	19.40	77 993	19.08
5- 9	16 492	11.10	18 288	8.03	39 683	12.56	61 496	15.02
10-14	21 251	14.31	23 167	10.17	23 117	7.31	42 832	10.46
15-19	22 736	15.30	29 935	13.14	29 451	9.32	27 336	6.67
20-24	20 163	13.57	31 724	13.92	36 391	11.52	33 765	8.24
25-29	16 492	11.10	27 798	12.21	37 124	11.75	40 048	9.78
30-34	9 245	6.22	19 856	8.72	30 060	9.51	38 467	9.40
35-39	5 922	3.99	10 703	4.70	20 716	6.56	30 419	7.43
40-44	4 877	3.28	6 705	2.94	11 151	3.53	20 780	5.07
45-49	3 953	2.66	5 381	2.36	6 995	2.21	11 193	2.74
50-54	3 182	2.15	4 315	1.89	5 564	1.76	7 012	1.71
55-59	2 401	1.61	3 430	1.50	4 405	1.39	5 459	1.33
60-64	1 634	1.10	2 579	1.13	3 450	1.09	4 223	1.03
65-69	1 280	0.86	1 770	0.78	2 541	0.80	3 202	0.78
70-74	1 061	0.71	1 345	0.59	1 697	0.54	2 244	0.55
75-79	739	0.50	1 022	0.45	1 198	0.38	1 390	0.34
80 and over	573	0.38	957	0.42	1 280	0.37	1 518	0.37
Total	148 546	100.00	227 771	100.00	316 138	100.00	409 377	100.00

Source: CONAPO, 1982.

Table 44: Estimated Population in the Microregion, 1985-2000[a]
(Programmatic hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	17 033	11.40	34 061	14.84	41 847	13.21	45 275	11.06
5- 9	16 508	11.06	19 030	8.29	35 887	11.33	43 784	10.70
10-14	21 304	14.26	24 061	10.48	26 742	8.43	44 039	10.75
15-19	22 806	15.27	31 130	13.56	34 094	10.75	37 427	9.13
20-24	20 235	13.55	32 982	14.37	41 489	13.09	45 135	11.02
25-29	16 554	11.08	28 890	12.59	41 724	13.16	50 907	12.43
30-34	9 275	6.21	20 382	8.88	32 673	10.30	45 664	11.15
35-39	5 934	3.97	10 941	4.77	21 926	6.91	34 188	8.35
40-44	4 884	3.27	6 386	2.98	11 775	3.72	22 642	5.53
45-49	3 958	2.65	5 472	2.38	7 397	2.33	12 274	3.00
50-54	3 186	2.13	4 387	1.91	5 869	1.85	7 777	1.90
55-59	2 403	1.61	3 486	1.52	4 648	1.47	6 050	1.48
60-64	1 637	1.09	2 627	1.15	3 652	1.15	4 708	1.15
65-69	1 283	0.86	1 814	0.79	2 718	0.86	3 611	0.88
70-74	1 064	0.71	1 381	0.61	1 848	0.59	2 585	0.63
75-79	740	0.50	11 049	0.45	1 309	0.41	1 646	0.40
80 and over	574	0.38	987	0.43	1 406	0.44	1 818	0.44
Total	149 376	100.00	229 516	100.00	317 004	100.00	409 530	100.00

Source: CONAPO, 1982.

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Table 45: Estimated Population in the Microregion by Age-Group, 1985-2000*
(Industrial-Port Hypothesis)

Age-Group	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
0- 4	21 364	8.13	68 254	11.55	119 415	11.54	169 257	10.80
5- 9	21 590	8.21	33 343	5.64	82 863	8.00	135 601	8.65
10-14	38 233	14.54	62 620	10.59	85 303	8.24	141 719	9.04
15-19	44 811	17.04	91 526	15.48	130 087	12.57	161 925	10.34
20-24	43 172	16.42	100 212	16.95	161 518	15.60	209 516	13.36
25-29	36 215	03.77	90 488	15.31	159 769	15.43	229 409	14.63
30-34	18 271	6.95	57 575	9.74	117 045	11.30	189 424	12.08
35-39	9 991	3.80	27 809	4.71	69 141	6.67	129 530	8.26
40-44	7 172	2.73	15 330	2.59	34 288	3.31	75 859	4.84
45-49	5 562	2.12	10 868	1.84	19 864	1.92	39 059	2.49
50-54	4 462	1.70	8 456	1.43	14 413	1.39	23 660	1.51
55-59	3 428	1.30	6 724	1.13	11 201	1.08	17 206	1.10
60-64	2 523	0.96	5 333	0.91	8 986	0.87	13 397	0.85
65-69	2 064	0.79	4 153	0.70	7 195	0.69	10 674	0.69
70-74	1 723	0.65	3 350	0.57	5 568	0.54	8 298	0.53
75-79	1 219	0.46	2 514	0.42	4 120	0.40	5 927	0.38
80 and over	1 131	0.43	2 674	0.44	4 661	0.45	6 969	0.45
Total	262 931	100.00	591 229	100.00	1 035 437	100.00	1 567 430	100.00

Source: CONAPO, 1982.

Table 46: Estimated Urbanization in the Conurbation and the LC Microregion, 1985-2000[a]
(Historical hypothesis)

Sector	1985 Population	1985 %	1990 Population	1990 %	1995 Population	1995 %	2000 Population	2000 %
National Level								
5,000- 9,999	46 875 575	58.61	57 119 764	61.21	69 346 279	63.34	84 021 772	65.46
10,000-19,999	39 933 415	49.93	48 795 825	52.29	59 416 207	54.27	72 200 194	56.25
20,000 and over	39 933 415	49.93	48 795 825	52.29	59 416 207	54.27	72 200 194	56.25
Conurbation								
5,000- 9,999	163 860	62.24	239 933	69.39	338 056	76.05	452 499	82.71
10,000-19,999	143 562	54.53	230 977	66.80	317 430	71.41	439 314	80.30
20,000 and over	143 562	54.53	219 366	63.50	317 430	71.41	421 260	77.00
Microregion								
5,000- 9,999	138 831	93.46	215 562	94.64	302 923	95.82	397 096	97.00
10,000-19,999	133 558	89.91	215 562	94.61	302 923	95.82	397 096	97.00
20,000 and over	123 442	83.10	198 320	87.07	290 973	92.04	397 096	97.00

Source: CONAPO, 1982.

Table 47: Estimated Urbanization in the Conurbation and the LC Microregion, 1985-2000[a]
(Programmatic estimates)

City size by number of inhabitants	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
National Level								
5,000- 9,999	45 861 211	58.61	52 652 046	61.21	58 982 778	63.34	65 487 100	65.46
10,000-19,999	39 069 276	49.93	44 979 178	52.29	50 536 712	54.27	56 273 288	56.25
20,000 and over	32 347 765	41.34	37 168 680	43.21	41 680 915	44.76	46 319 168	46.30
Conurbation								
5,000- 9,999	164 987	62.32	248 213	71.24	358 861	80.51	488 572	89.27
10,000-19,999	144 522	54.59	238 701	68.51	335 817	75.34	473 357	86.49
20,000 and over	144 522	54.59	226 646	65.05	335 817	75.34	452 560	82.69
Microregion								
5,000- 9,999	138 950	93.69	222 630	97.00	307 494	97.00	397 244	97.00
10,000-19,999	134 618	90.12	222 631	97.00	307 494	97.00	397 244	97.00
20,000 and over	124 400	83.28	204 636	89.16	307 494	97.00	397 244	97.00

Source: CONAPO, 1982.

Table 48: Estimated Urbanization in the Conurbation and the LC Microregion, 1985-2000[a]
(Industrial-Port Estimates)

City size by number of inhabitants	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
National Level								
5,000- 9,999	45 861 211	58.61	52 652 046	61.21	58 982 778	63.34	65 487 100	65.46
10,000-19,999	39 069 276	49.93	44 979 178	52.29	50 536 712	54.27	56 273 288	56.25
20,000 and over	32 347 765	41.34	37 168 680	43.21	41 680 915	44.76	46 319 168	46.30
Conurbation								
5,000- 9,999	293 542	84.00	642 578	94.44	1 098 027	97.00	1 620 635	97.00
10,000-19,999	287 951	82.40	612 436	90.01	1 030 335	91.02	1 620 635	97.00
20,000 and over	275 196	78.75	593 997	87.30	1 044 824	92.30	1 566 670	93.77
Microregion								
5,000- 9,999	255 043	97.00	573 492	97.00	1 004 374	97.00	1 520 407	97.00
10,000-19,999	255 043	97.00	573 492	97.00	1 004 374	97.00	1 520 407	97.00
20,000 and over	255 043	97.00	573 492	97.00	1 004 374	97.00	1 520 407	97.00

Source: CONAPO, 1982.

- The historic hypothesis goes even further. It predicts that by the year 2000 more than three-quarters of the population will be found in towns of more than 20,000 inhabitants, and 82.71% will have settled in towns of over 5,000. This size town is expected to grow somewhat more slowly than in the other two hypotheses: 62.24% by 1985, 69.39% by 1990 and 76.05% by 1995.

Population by type of activity: the results of the CONAPO calculations of the composition of the economy in future years are surprising. Given the forecasts of the degree of urbanization, tendencies towards population concentration on the coast, and the agro-industrial characteristics of the conurbation, the three hypotheses on which the calculations were based predict a fairly close balance up to the year 2000 in EAP absorption by the primary, secondary and tertiary, sectors of the economy.

The rate of growth hoped for in each sector has been calculated for the conurbation as a whole but not for the micro-region. Detailed information can be found in Table 49, in which the following points are worth noting.

- The industrial-port hypothesis, which maintains that by 1990 94.4% of the population will be concentrated in towns of over 5,000 inhabitants, predicts that by the same year the primary sector of the economy will have absorbed 28.6% of the 239,480 economically active members of the population, and the secondary and tertiary sectors 32.10% and 39.30% respectively. Structural changes in the economy up to the year 2000 are expected to be slow, with a diminishing primary sector (to 26.90%) and an increase in both secondary and tertiary sectors to 33.20% and 39.90% respectively. Despite the relative decrease in the primary sector, this hypothesis forecasts the impressive incorporation of 165,819 people into this sector.
- The programmatic hypothesis, which maintains that by 1990 71.24% of the population will be concentrated in towns of over 5,000 inhabitants, predicts that by the same year the primary sector will absorb 43.60% of a total EAP of 111,329 people, and the secondary and tertiary will incorporate 25.30% and 31.10%, respectively. For the year 2000 this hypothesis predicts a total EAP of about 195,000, of which the primary sector will absorb 34%, the secondary 30.40% and the tertiary 35.60%.
- The historic hypothesis, which maintains that by 1990 69.38% of the population of the conurbation

Table 49: Estimations of the Economically Active Population by Sector of the Economy, 1985-2000[a]

Sector	1985		1990		1995		2000	
	Population	%	Population	%	Population	%	Population	%
National Level								
Total EAP	24 091 158	100.00	27 614 576	100.00	31 477 116	100.00	36 098 197	100.00
-Primary	8 720 999	36.20	9 112 810	33.00	9 317 226	29.60	9 421 629	26.10
-Secondary	6 938 254	28.80	8 422 446	30.50	10 230 063	32.50	12 453 878	34.50
-Tertiary	8 431 905	35.00	10 079 320	36.50	11 929 827	37.90	14 222 690	39.40
Conurbation (Historical Hypothesis)								
Total EAP	82 330	100.00	106 378	100.00	127 666	100.00	148 526	100.00
-Primary	39 848	48.40	47 657	44.80	52 215	49.90	54 806	36.90
-Secondary	18 936	23.00	26 382	24.80	34 470	27.00	43 221	29.10
-Tertiary	23 546	28.60	32 339	30.40	40 981	32.10	50 499	34.00
(Programmatic Hypothesis)								
Total EAP	82 625	100.00	111 329	100.00	149 072	100.00	194 874	100.00
-Primary	39 908	48.30	48 539	43.60	57 393	38.50	66 257	34.00
-Secondary	19 004	23.00	28 166	25.30	41 889	28.10	59 242	30.40
-Tertiary	23 713	28.70	34 624	31.10	49 790	33.40	69 375	35.60
(Industrial-Port Hypothesis)								
Total EAP	117 177	100.00	239 480	100.00	407 745	100.00	616 427	100.00
-Primary	36 911	31.50	68 491	28.60	114 169	28.00	165 819	26.90
-Secondary	35 739	30.50	76 873	32.10	132 925	32.60	204 654	33.20
-Tertiary	44 527	38.00	94 116	39.30	160 651	39.40	245 954	39.90
Microregion	N.D.		N.D.		N.D.		N.D.	

Source: CONAPO, 1982.

> will be concentrated in towns of over 5,000 inhabitants forecasts that, for the same year, of a total EAP of 106,378 people, 44.80% will be employed in the primary sector, 24.80% in the secondary and 30.40% in the tertiary. For the year 2000 it is estimated that of an EAP of 148,526 people, 36.90% will be employed in the primary sector, 29.10% in the secondary and 34.00% in the tertiary.

In Chapter 4 we pointed out the present characteristics of agrarian areas and some of the tendencies foreseen in the near future. At this point we wish only to point out that agro-industrial potential is low, especially in the mountain sub-region, and there is a general tendency for expanding urban sectors and capitalist farming methods to commandeer fertile, wellwatered land. The likelihood that in the next two decades the primary sector will absorb 55,000 people, as claimed by the historic hypothesis, 66,000 as claimed by the programmatic, or 166,000 as claimed by the industrial-port hypothesis, would appear to be very slight, unless great changes come about first. Changes would have to take place in mining, and include impressive steps forward, and intensive investment of capital, in agro-industry. And even so, longstanding employment tendencies would make things rather difficult. It is enough to recall that in 1980, almost half of the EAP of only 6,000 people in the Coahuayatla municipality were unemployed, and in none of the municipalities (perhaps with the exception of Lazaro Cardenas) did population increases correspond to rises in EAP or to sectorial shifts in the area.

Chapter 6: THE FORMAL EDUCATIONAL SYSTEM

1. The situation prior to the emergence of the 'poles'

Until 1970 the conurbation was characterized by an extremely high illiteracy rate and very low levels of schooling; the national average of illiteracy in the population over the age of ten was 24%; here the rate was almost double - 44.4%. Between 1960 and 1970 a significant increase in the literacy rates had been achieved, but not enough to decrease the total number of illiterate persons, which was growing at the same rate as the country as a whole. Illiteracy had decreased in the conurbation from 67.1% to 44.4%, but in real numbers it had increased from 17,463 to 25,265 people.

In the municipalities and in the five-year age-groups (see Table 50) the situation did not change much during this period. La Union and Coahuayutla showed the highest rates, but backwardness was so general that in 1970 a third of the youngsters of 10 to 14 years of age were illiterate, even in the municipality of Lazaro Cardenas. The most important factor in explaining the illiteracy rates, and the perpetuation of the problem from one generation to the next, is the number of children attending elementary school, which was extremely low. Although by 1970 98% of all the children 8 years of age in the country had access to education, the highest rate for the conurbation was 52% (Table 51).

Late access to and irregularity in schooling in the various counties of the conurbation were manifest not only in the number of people outside the system, but also in the range of ages within each class caused by repeating and late entry. Although Table 4 contains aggregate data and is not necessarily representative of typical classroom distribution, it characterizes the region as a whole, and in rural areas the situation is complicated further by one-room schools in which one teacher simultaneously teaches all grades in the same classroom.

In Coahuayutla, 80% of the children started first grade late; in La Union the figure was 77% in José Azueta 70%, in Lazaro Cardenas 65% and in Arteaga 63%.

Table 50: Illiteracy by age group (10 years and over), by county
(in percentages and absolute numbers)

County and age group	Illiterate population 1960 %	number	1970 %	number
Coahuayutla				
10-14	80.7	1 290	44.9	652
15-19	71.6	848	43.1	461
20-29	73.0	1 356	51.4	743
30-39	69.4	873	53.2	555
40 and older	76.6	1 664	59.8	1 147
Total	74.7	6 031	50.8	3 558
Tte. Jose Azueta				
10-14	58.4	798	36.3	936
15-19	51.3	508	37.3	681
20-29	56.2	797	42.8	1 083
30-39	61.7	639	54.4	925
40 and older	65.2	1 083	64.7	1 787
Total	59.1	3 825	47.5	5 412
La Union				
10-14	72.0	1 103	47.5	905
15-19	66.0	709	43.1	576
20-29	67.9	980	48.8	968
30-39	71.9	734	59.3	731
40 and older	76.1	1 264	68.3	1 384
Total	71.2	4 790	53.8	4 564
Arteaga				
10-14	67.4	1 100	46.3	1 119
15-19	62.6	830	40.4	651
20-29	-		44.4	1 024
30-39	-		52.2	851
40 and older	-		62.6	1 653
Total	-		49.9	5 278
Lazaro Cardenas				
10-14	53.2	542	33.2	1 138
15-19	44.1	345	30.5	751
20-29	-		37.0	1 331
30-39	-		48.1	1 127
40 and older	-		57.9	2 076
Total	-		41.6	6 423
Total Conurbation				
10-14	67.6	4 833	40.3	4 780
15-19	60.5	3 240	37.6	3 120
20-29	66.4*	3 133	43.4	5 149
30-39	67.8*	2 246	52.7	4 169
40 and older	73.0*	4 011	62.2	8 047
Total	67.1*	17 463	44.4	25 265

(*) Information available for Coahuayutla, José Azueta, and La Union only.

Source: National Census 1960 and 1970

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Table 51 - Elementary school enrolment rates (in %) for 1970 by age

	Age								
Municipality	6	7	8	9	10	11	12	13	14
Coahuayutla	12	29	38	47	48	53	43	42	38
José Azueta	20	38	52	55	55	64	56	53	40
La Union	10	24	29	41	41	43	39	41	31
Arteaga	18	34	39	46	45	45	43	38	29
L. Cardenas	16	32	44	51	53	54	54	51	43
Rates (%) Total national	51	88	98	92	92	82	73	n.a.	n.a.

Source: 1970 Population Census.

Post-elementary education also suffered from very low levels in the conurbation, for in 1970 only 2.6% of the overall population (1,649 people) had had formal education above elementary level. Lazaro Cardenas was the county that had the highest level: 657 people had had post-elementary school education; 78 of these had higher education (48 having completed their courses). In Coahuayutla only 42 people over the age of 12 had post-elementary education (10 of whom had higher education, 2 having completed their courses). In La Union the situation was not much better: 130 people had post-elementary education, of whom 24 went to university, and 16 obtained degrees (see Table 52).

There were problems not only of general lack of school services, but of repeating, drop-out and absenteeism. Although we have no specific information on the quality of education, the lack of a unified programme, the need to resort to one-room schools, and the tendency to relegate the most deficient educational services to the most backward areas, lead one to suspect that it was fairly defective.

This was the situation of the regional offer of human resources at the time when work on the infrastructure, but not the large industrial projects, had begun. It is clear that skilled personnel came from outside this region, and that local inhabitants were the unskilled labour. It is also clear that the resulting industrialization process was based on companies that recruited their personnel from other parts of the country and from abroad, in spite of the many theories that specify a certain level of education as prerequisite to industrial expansion, or particularly educational expansion as prerequisite to economic growth. What we see here is that at a regional level, the increase in the supply of education is a result of economic growth, rather than the reverse.

However, it is obvious that industrial expansion was made possible by qualified personnel from outside, and that important qualitative and quantitative problems are closely related to the dynamics of production and productivity. These will be discussed below.

2. The situation in the period 1970-1980

Expansion of the industrial and tourist poles and the growth occasioned by it, was to affect the demand for education considerably. The governments of Luis Echeverria and José Lopez Portillo fostered, and provided resources for, rapid expansion of the schooling system at all levels throughout the nation. Of all the social services, education is the one that has expanded most rapidly, because it fulfils the aspirations

Table 52 - Post-primary education in 1970 (population age 12 and over) 1970 absolute value

County	Total	High School		Sub-professional			
		Junior high or pre-vocational	Senior high vocational	Technical with junior high	Technical with senior high	University	
Coahuayutla	42	23	3	2	4	10	(2)*
José Azueta	376	226	60	36	9	45	(26)*
La Union	130	74	20	7	5	24	(16)*
Arteaga	444	354	28	30	4	28	(20)*
L. Cardenas	657	458	78	33	10	78	(48)*
Total	1649	1135	189	108	32	185	

* Number of persons with degrees.

Source: 1970 Population Census.

of all sectors of the population. In the field of post-elementary education, however, the Ministry of Education's insistence on the provision of basic- and medium-level technical education was fulfilled despite the social demand for the traditional kind of course (baccalauréat) which facilitates upward mobility.

Elementary-school services grew rapidly, particularly in Lazaro Cardenas at first, not only because of the concentration and heterogeneity of the population, but because of economic and socio-political demands, as job opportunities began to depend much more closely on a minimal education. In rural areas the availability of elementary-school education became more generalized with the advent of schools with incomplete curricula (less than six years) and later with complete schools as the size of the population began to justify them.

Tables A.6.1 and 2 in the Appendix to Chapter 6 give some idea of the enrolment in the elementary system of the conurbation at the beginning of the year 1980-1981. We have at our disposal information pertaining to high-school education the same year, some published by the Ministry for Education, and some prepared especially for us by school inspectors in each of the zones. Elementary-school data were obtained through questionnaires distributed to both elementary and high schools.

The level of education throughout the conurbation is described in the following paragraphs:

i) Pre-school

There are very few data on the availability of this service, except in the counties of José Azueta and Lazaro Cardenas, the latter, according to the Office of Educational Co-ordination, having a considerable number of establishments (27) which 2,535 children attend. Table 53 shows the distribution of these schools by type.

Table 53 - Schools by type

Establishments	Type	Pupils	Groups	Teachers
16	Federal	1 264	39	30
8	D.I.F. *	605	19	20
3	Private	666	23	25

(*) Departmento de Integracion Familiar

José Azueta reports that it has four kindergartens, attended by 276 children.

The Ministry for Education (SEP) reports that there is one kindergarten in Arteaga which accommodates 100 children. However, this information does not seem to be reliable, because it also reports that for the same year there was only one in Lazaro Cardenas, which had only 100 children.

No information was available for Coahuayutla (where we suspect that there are none), La Union (where there must be very few) and Arteaga, where services must exist, as there is an important urban sector and a teachers' training college.

The presence of kindergartens is related to the degree of urbanization and the growth of a middle class which, in the case of Lazaro Cardenas, actually provides the service through private schools. Although these are not priority services, they constitute a pedagogical necessity in the sense that one sector of the population (the middle class) starts sending its children to school at an early age. Not only do these children have a considerable advantage when they start elementary school, but the children of working mothers are better looked after than they would be if their mothers, out of necessity, had left them with older brothers or sisters or, in extreme situations, alone.

Increased urbanization and the incorporation of women into activities requiring a set timetable, away from home, will probably mean a 'spontaneous' increase in the number of nurseries and kindergartens. The problems faced by the working mother could be solved, and pedagogical needs filled, through better specialized state support services, union organizations, and companies whose size would make it possible to provide the human and economic resources necessary.

ii) Elementary level

It turned out to be very difficult to calculate the exact number of elementary schools and pupils in the conurbation, for several reasons. The first had to do with the fact that the school zones are sometimes covered by the SEP, sometimes by state governments. It was only in the county of Lazaro Cardenas that information on elementary schools under the exclusive control of the Ministry for Education was to be found. This, and the efficiency of the municipal co-ordination offices made it possible to obtain current information. In Arteaga county, we obtained up-to-the-minute information on the number of schools, pupils, teachers, classrooms and groups.

Second, the state school inspection system (and even the federal system) often covered municipalities outside the conurbation, complicating the work of sorting out the information which was not completed. This was the case in Teniente José Azueta, where the SEP registered 15 schools, but only a few of them actually belonged to this county. Data obtained from the municipality, however, showed that there were 26 state teachers in the county (12 in Agua de Correa, 4 in Buena Vista, 4 in Real de Guadalupe, 3 in Los Achotes and 3 in La Perota), and 12 county teachers. In La Union, the state government reported 4,000 pupils in School Zone No. 16. This same sort of situation occured with the SEP, although to a lesser degree. School Zone No. 53, for example, comprises 54 schools in Petatlan, Tecpan, and Tte. José Azueta; only four of them are located in Tte. José Azueta (plus one under construction).

Third, we found that a new school zone (No. 48) had been created for Coahuayutla, but it was not in the latest records of the SEP. In the records for the 1979-1980 school year, the schools in this county were included in the School Zone 34, whose seat was in La Union.

Fourth, the private schools (which come under the SEP of the state government) were difficult to count. Only in Lazaro Cardenas was the situation clear. There were also services in Arteaga and Zihuatanejo (in the former there were two schools, one private and the other state).

Despite these difficulties it was possible to assess the present situation, probably with a very low margin of error. For our purposes, we classified the schools belonging to School Zone 18 as state, and those coordinated by the county of Arteaga (5 schools with 654 pupils) in other zones.

Table 54 shows the elementary schools and the number of pupils for each county in the Lower Balsas River Conurbation (school year 1980/1981).

Table 54 - Elementary education; number of schools and enrolment, 1980/1981

Control	L. Cardenas	Arteaga	J. Azueta	La Union	Coahuayutla
SEP	50 (16 417)	10 (2 556)	45 (7 842)	49 (5 066)	35 (2 561)
State	-	6 (838)	7 (1 400)	8 (1 400)	-
Private	3 (666)	2 (225)	2 (399)	-	-
Others	5 (2 043)	6 (1 131)	-	-	-
Totals	58 (19 120)	24 (4 740)	54 (9 641)	57 (6 466)	35 (2 561)

We calculated that there are 228 elementary schools in the Conurbation, with 42,528 pupils enrolled. The rate of growth in school facilities as well as in the number of pupils has been considerable in the past few years. In the data for the past five years alone, we find the highest concentration of population in the coastal municipalities where there has been the most rapid growth.

Table 55 shows the growth in elementary school services in the Conurbation during the five-year period from 1975 to 1980, by county.

Table 55 - Number of elementary schools, 1975-1980

County	1975	1980	Growth (%)
L. Cardenas	31	58	87
Arteaga	22	24	9
J. Azueta	23	54	135
La Union	28	57	104
Coahuayutla	20	35	75

(1975 data was provided by SEP: E. Rosenbluth Data Center)

In general the school facilities have (among others) the following characteristics.

- all the important towns in the conurbation have schools that provide complete elementary studies;
- even in the most scattered rural areas there are a number of elementary school facilities, as we will see in the more detailed description; this is particularly true of La Union and José Azueta and to some extent, Coahuayutla. In all three counties in the State of Guerrero, there is at least one school for each section of the territory;
- in the state of Michoacan there are considerable stretches of territory (particularly in the regions north-east of Lazaro Cardenas, all along the border between Lazaro Cardenas and Arteaga, and south-east of Arteaga) where there is not one school;
- in the past few years the extension of school facilities in the rural areas has consisted of providing one-room schools that work in provisional classrooms or simply out of doors. These occur particularly frequently in the State of Guerrero;

- with few exceptions, the schools in the county of Lazaro Cardenas provide complete elementary schooling (6 grades), usually with more than one teacher. In the urban zones the majority of the schools work more than one shift (usually two) and when class sizes reach 30 to 40 pupils, new classes are formed. If the increase in population continues, multiple shifts will be insufficient to meet the demand and more schools will have to be built. Smaller towns tend to have one or two classrooms, with one teacher for each. The few schools that do not provide complete elementary schooling are located in towns such as El Mango, La Parotilla, La Manzanilla, Popoyutla and Mexcuchuacan. There are schools that work with many pupils in a single classroom and there are a couple of schools with 100 pupils in only 2 classrooms. A solution similar to that of School Zone No. 34 in La Union might be recommendable as a first step towards providing school facilities for the population of these regions;
- the county in which the situation remains virtually the same, in comparison to the dynamic growth of those on the coast, is Arteaga. School facilities have not changed over the past few years, and they are located in settlements near the highway that crosses it from east to west. Only in the county capital and J.M. Morelos are there classrooms for each grade and class; in the rest of the towns classes are taught in 1, 2 or 3 classrooms with one teacher for each. Vast regions of the territory have no schools at all;
- in Coahuayutla, which is far from the routes that will eventually connect it with the metropolis and the local centres of development, only Galeana and the municipal capital have sufficient classrooms for each grade, and only in Coahuayutla is there a teacher for each grade. In the other towns the schools work with one or two classrooms, one teacher for each. The isolation of these towns, and of the county itself, makes it difficult to attract teachers. Within the conurbation it is certainly Arteaga and Coahuayutla that require the greatest effort;
- in the county of La Union we were most impressed by the way in which elementary-school facilities have been extended. Virtually any town that requests a school receives an immediate reply from the

authorities, and the integration of school and community in the most isolated areas seems to be making gratifying progress. Of course, expansion often means incomplete elementry instruction of less than six grades, with one teacher, and there are many schools that work without even one classroom; where the classrooms have been built by the community, they are incredibly makeshift. All this reflects the sacrifices made by the teachers, the efforts of the community, and the magnitude of the problems still to be solved;

- in José Azueta, the nature of school facilities would appear to be a combination of those in Lazaro Cardenas, where most of the schools provide complete elementary studies and those in La Union, where facilities have been made available to the smaller rural communities where the population is dispersed. In towns where access is easy and urbanization fairly advanced (at least as far as the number of inhabitants is concerned), schools offer complete courses and, as we will see below, there is already a demand for medium-level education. While it is true that many are working in makeshift classrooms, the problem is similar in other counties;
- the schooling facilities provided in the mountain regions attract many people from neighbouring hamlets. As we stated above, these little schools that operate with one teacher and 30 to 60 pupils are an indication of the social demand for education, and the way in which this demand has been met, albeit temporarily;
- the high incidence of schools offering incomplete programmes of instruction, and their total absence in a number of regions, show the urgent need for the formation of boarding schools offering complete courses in strategic areas, especially in the mountains. This type of school would be able to absorb a number of children that would normally not be able to finish school, either because there was not one in the area or because it offered too few courses. An economy-of-scale strategy could offer educational facilities of a much higher standard, together with medical and other services that are lacking in the mountains.

The sample of elementary schools (our intention here had been to examine all the schools) is particularly large owing to the fact that we distributed questionnaires to 181 schools, which accounted for 79.4% of all the schools registered in the

SEP. The percentages of the pupils examined in each county were as follows:

La Union	94.7%
Coahuayutla	88.6%
L. Cardenas	74.1%
Arteaga	79.8%
J. Azueta	66.7%

The types of organization controlling the schools are shown in Table 56.

Table 56 - Types of schools by counties

Control	Coahuayutla	Arteaga	La Union	J.Azueta	L. Cardenas	Total
Federal	30	10	43	28	31	142
State	1	5	11	7	7	31
County	-	1	-	-	-	1
Private	-	1	-	1	-	2
Other	-	-	-	-	-	5
Total	31	17	54	36	43	181

Source: Padua, J., Zapata F. y Pucciarelli, A., 1981: Recursos Humanos y Organizacion a la Communidad en la Zona Conurbada de la Desembocadra del Rio Balsas, Mexico DF, OCTE/CONURBAL.

These figures give rise to the following remarks:

- If schools are broken down according to the degree of urbanization of their locales (town or city with urban services, small town with some urban services, and hamlet or dispersed rural community), and the year of opening of the school, it is clear that the expansion of school facilities, has responded to the demand, and that two-thirds of the schools now cover hamlets and dispersed rural communities. In 36.5% of the cases the schools were new (1980); 22.1% had been working for one to five years; and 16% for six to ten years; i.e. 75% of the schools in the Zone had been establsihed in the last ten years. It is therefore understandable that if, until 1970, in a region with an area of over 11,000 square kilometres, there were only 146 schools, the rate of illiteracy was as high as 70%.

- The number of pupils attending school was found to be 33,465 (17,258 boys and 16,207 girls). Of these 42% were from Lazaro Cardenas, 9% from Arteaga, 7.5% from Coahuayutla, 23% from José Azueta, and 18% from La Union (see Table A.6.1 in the Appendix to Chapter 6).
- Assuming that all those in the sample were to graduate, 2,781 pupils would have finished sixth grade in the school year 1980/ 1981. If the correction factor for the total were to be applied, at the end of the school year 3,365 pupils would have graduated, most of them from the Lazaro Cardenas county (about 50%) and José Azueta (27%). If two-thirds of these pupils were to enrol in the next higher level of studies (this estimate is low according to national trends), the schools for basic medium-level education in the conurbation would have to absorb 2,250 first-year students.

The county of Coahuayutla has the lowest number of pupils. Although elementary schooling has reached geographically isolated areas, this has been done through the use of "one-room" schools that do not provide the complete course. The isolation of the area in itself contributes to an underestimation of education as far as completing a course is concerned. The proportion of one sixth-grade student to every ten in first grade is easily explained by the combination of these two factors. The effort required to improve this municipality would be considerably more than that needed for those on the coast.

A similar though not quite as serious situation occurs in Arteaga (where there is one pupil in sixth grade for every five in first grade) and La Union (where the proportion is one to four), where medium-level educational facilities are easier to establish owing to the considerably higher degree of urbanization than in the Coahuayutla municipality.

- The most favourable situation is to be found in the counties of José Azueta and Lazaro Cardenas. For every sixth-grade pupil there are three in first grade, which indicates much better coverage. Facilities are still required, however, for a number of pupils in isolated regions, plus those children from the outskirts of the urban zones, particularly the municipal capitals and towns like Guacamaya and La Mira.
- "One-room" schools are numerous, which is obvious from the great number of schools with only one classroom, which is usually temporary. Twenty-seven per cent of the schools worked with only one

classroom, 20% with two and only 30% with six or more. Owing to their urban characteristics, the municipalities with the greatest availability of school classrooms were Lazaro Cardenas and José Azueta. The least satisfactory was that of Coahuayutla, where only two schools had a classroom for each grade. A serious problem exists as regards accommodation capacity, and this is aggravated by the problem of facilities. An outstanding example is the absence of sanitary installations in most of the schools, which do not even have a septic tank.

- Obviously there is a very close relationship between the number of classrooms and the number of teachers. In Coahuayutla, 61% of the schools had only one teacher (only one school had more than five), in La Union 39% had one teacher (only 26% had six or more), in Arteaga the figure was 29% (with 23% having more than 5 teachers), in José Azueta 17% (42% with over six) and in Lazaro Cardenas 11.6% (63% having seven or more).
- According to the teachers (also from what we observed), the supplies of equipment were unsatisfactory. Responses on this point indicated that supplies were either inadequate or non-existent in 81% of the schools in Coahuayutla, 65% of those in Arteaga, 81% of those in La Union, 75% in Azueta and 81% in Lazaro Cardenas. Here we are talking about basic items such as chalk, exercise books, blackboards, desks and tables.
- The student drop-out rate is a serious problem, according to the general opinion of the teachers, although there are not enough data available to make precise calculations. The problem is worse in Coahuayutla and rural areas than it is in the urban, where the drop-out rate is minimal. Economic problems constitute the main cause (69%). Academic problems account for fewer than 2% of the cases, as do problems of motivation.
- The county of Lazaro Cardenas was able to provide reliable and current information for the school year 1982/1983. Growth in the most important towns had continued to be intense and in Lazaro Cardenas alone the number of children at elementary school had risen from 6,326 to 8,032 in two years (a 26.26% increase). In the town of La Mira, the number of pupils increased from 2,071 to 2,542 (22.74%) and in Guacamayas from 5,523 to 6,405 (16%). The overall increase had been 17.68%, reaching a total of 22,600 pupils in the county.

The middle level: at the beginning of 1981 there were thirty middle-level schools - 25 lower middle, 4 higher middle (1) and one teacher-training college (2). The type of education provided was technological in 15 of the schools; 5 were agro-industrial, 10 industrial and/or commercial, 7 general secondary, 3 for workers, 4 for the bachillerato, 1 for training teachers.

All the schools are in urban areas where the population is most concentrated, and all but two - an agricultural/technical school in Playa Azul, Lazaro Cardenas county, and a general secondary school in Infiernillo, Arteaga - are in county capitals. In Guacamayas there is a school which is integrated in the Lazaro Cardenas system. Coahuayutla is the most backward, having just one high school serving only 80 students. In La Union service is limited to three technological schools where there are a total of 1,300 students. In Arteaga 1,700 students study at this level, half of them at the teacher-training college.

José Azueta and Lazaro Cardenas have the best range of facilities, and they are the only counties that offer upper middle-level programmes.

In Zihuatanejo in 1979-1980 there were 3 lower middle-level schools, serving a total of 1,865 students; one was a general high school, the second for workers, and the third was an agro-industrial school. In 1980-1981 there were 2,136 students enrolled, which meant an increase of 14.5% in that year. In the 2 senior high schools there were 308 pupils in 1979-1980. One was incorporated into the National University at Guerrero, and worked with two shifts. The other was federal and had only evening classes. By 1980-1981 the number of students dropped to 541, but the terminal upper-middle CONALEP school, initiated in 1980 with 33 students, had 240 by 1981. Altogether the two schools providing complete high-school education had grown by 14.3%. The total number of students attending a secondary school in 1980-1981 was 3,285 which is 15% more than in the previous year.

In the 11 secondary schools in Lazaro Cardenas county there were 4,900 lower- and 1,100 upper-level students in 1979-1980. The enrolments in each type of school in 1980-1981 were as follows:

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(1) (T.N.) These two levels are each three-year courses roughly equivalent to junior and senior high school.

(2) (T.N.) In Mexico, training for elementary-school teachers is provided at this level, which is roughly equivalent to senior high school.

- 4 general middle-level schools served 3,724 students (one school for teachers and one for workers, both working two shifts, in the capital, one general school in Guacamayas, and one in La Mira);
- 3 technical schools served 1,139 students (one industrial and/or commercial school with two shifts and 1,459 students located in Lazaro Cardenas, one agro-industrial school with 419 students in Playa Azul, and one new technical fishing school in Caleta de Campos with 61 students);
- one general preparatory school with 445 students;
- one upper middle-level industrial technology and/or commercial centre in the capital with 910 students in two shifts;
- one National College for Professional Technical Education (CONALEP) in the capital with 651 students;
- one Technical Marine Studies Centre in the capital with 164 students.

All in all, there were 5,663 students at the lower middle level in the 1980-1981 school year. At the upper middle level there were 1,725 students. Specialized courses in the industrial and/or commercial technological schools at the lower level are technical drawing, secretarial studies, auxiliary accounting, soldering and forging, and electricity. Eighty per cent of the students go on to the upper middle level, and 20% are incorporated directly into the labour force. The school of industrial technology has been in operation for sixteen years, and is thus the oldest in the area. Those students who go out to work straight away are usually in technical drawing and secretarial studies. The capacity of each specialization is determined through a quota system, so that each is fairly treated. The total first-year admission capacity, with two shifts, is 500 students. Last year 650 candidates applied, and those that were refused admission were incorporated into other schools in the town.

The school of fishing technology began offering courses in 1981/1982, with 61 students.

The specializations in the upper middle level schools offering complete courses tend to compete with each other. In the Industrial Technology and Services Centre (CET No. 34) the student population is divided among the six specializations as follows:

Accounting	18.3%
Bilingual secretarial studies	10.5%
Community development	9.8%
Electricity	0.1%
Industrial maintenance	30.9%
Port operations	1.6%

According to our sources, demand exceeds the supply; 200 students were refused admission to the first year. From the very beginning of the course, the students are informed that the system is terminal, and will not prepare them to continue their studies. Approximately 50% of the students are children of technicians, 30% children of labourers and 20% children of farmers. They leave school between the ages of 20 and 22, but their chances of finding a job are not good.

The National College for Professional Technical Education was initiated in Lazaro Cardenas in 1980 with specializations in heavy construction and port administration. Theoretically there were six specializations in 1982-1983, but in fact there are only four in operation. The school has a capacity for 1,200 students but managed to attract only 600. Ninety per cent of these students are the children of rural households, and many have been refused admission to other schools. The specializations offered are port administration (50% of the students) and mechanical manufacturing (14%), both offered in the evening; day-time courses are offered in heavy construction (30% of the students), and steel forging and moulding (6%). The age of the students varies. The normal-age group for this level would be from 16 to 18; here 57% are between 15 and 19 years of age, 24% between 20 and 22, and 19% are over the age of 23. The student population is 73% men, and 27% women. Twelve per cent of the students are married; 21% study and work at the same time. The two specializations not yet implemented are metal manufacturing and soldering, probably because contact has not been formally established with the iron and steel industry. This is important because in the interviews it was clear that the staff considered that there were greater work possibilities for the students in NKS, PMT, Fertimex, CONASUPO and the industrial port. CONALEP's manner of operating is related to the productive system that is shown clearly in the agreements that have been signed with various companies. For example, in Lazaro Cardenas, there is a signed agreement with the Japanese industrial group NKS, which with the participation of Kobe Steel, NAFINSA and SIDERMEX, will install a foundry, forging, metal manufacturing and heavy machinery plant in the industrial port. The factory, which will consist of five workshops, will begin operations in the next few months. In February 1982 an agreement was signed in which the following was specified:

- NKS and CONALEP were to formulate training programmes and refresher courses for the training of qualified technicians and labourers for NKS, for which both parties would provide the human, technical, material and financial resources necessary;

- CONALEP agreed to:
  - establish a school in the town of Lazaro Cardenas where mechanical, metal and steel manufacturing, moulding, forging and soldering instruction would be provided initially for NKS exclusively, for at least four years;
  - establish a Centre for Training and Continued Education and provide short training courses to satisfy the training and specialization needs of NKS labourers and technicians;
  - train the instructors required by NKS in these specializations.

The following were to be attended to by a CONALEP-NKS commission:

- authorization of construction plans and programmes for the school,
- establishment, revision and modification, where necessary, of the study plans and programmes, and the design, organization and execution of programmes and training courses,
- selection of teachers for the school,
- setting the terms, procedures and conditions to prepare the way for specific courses required by companies other than NKS.

Both parties agreed that at no time, under no circumstances, should the graduates of the school consider themselves employees of NKS, unless they were selected and contracted by the organization.

NKS agreed "if and when it was possible and legally feasible" to

- provide CONALEP with the experience, technology and materials at its disposal, so that all the necessary elements would be available for the fulfilment of the agreement;
- provide authorizations for students to visit the installations and carry out practical experiments;
- provide authorization for its personnel to give courses and seminars at CONALEP;
- contribute 40 million pesos over a period of two years;
- cover the living expenses of four Mexicans to be sent to Japan for training as instructors (CONALEP would pay the air fares);
- assign four qualified technicians to CONALEP as instructors for one year.

At the end of the four-year term of the agreement, NKS would have rights to training and refresher courses for its personnel.

The agreement may initially appear to be closely controlled by the company and very costly (800,000 US dollars at the time of signing the agreement and 267,000 US dollars in April 1983), but it should be seen not only from the point of view of training middle-level technicians or of systems of socialization and reproduction, but also as an important experiment in industry/education relationships. A number of important questions arise, questions requiring further research to find the specific answers, for example:

- How do experiences with the same courses (metal manufacture, for example) in the various towns where companies have signed agreements with CONALEP compare? Are different criteria used as regards plans, programmes and teaching methods, and the degree of importance given to general content, practical applications, etc?

  The most common theory is that the employers have only a very vague idea of the educational profiles required for positions, that they operate within a strategy to attain a satisfactory standard but not a high one, and only when the yield falls well below minimum level are changes in methods and personnel resorted to (see for example Dill, et al, 1962; March and Simon, 1958; and Brooke, et al, 1978). Leaving aside for the moment the whole problem of education and the abilities expected for a given post, whether it be at the level of labourer, technician or executive, what is interesting to note here is the norms that are incorporated into study plans and programmes by organizations such as CONALEP and other companies. Admittedly, our interviewing of employers was usually carried out with such company representatives as managers or those in charge of hiring personnel.

- What is the situation when those involved are technicians or engineers working in the different manufacturing processes?

  Vivas, Carciofi and Filgueiras (1980) in Argentina, studying human resource training at the university level, interviewed professionals working in companies; they observed that these people had a fairly precise idea of the abilities and functions expected of them. We do not know if this is the case in Mexico or if the same is valid for the technicians.

- How do Japanese, American, Mexican and other companies' ideas of the training of technicians in Mexico by CONALEP differ one from the other?

- Do the ideas of the CONALEP executive branch concerning the training of technicians differ from those of the directors of each college and from those of company management?

  The impression gained from leaflets describing functions in the industrial area, and from interviews with those involved in the training of these young people, is that their image of a technician resembles that of a skilled labourer.

- Would the image of a technician be different in Europe or the US?

- What is the nature of the relationship between CONALEP, which has already signed an agreement with one company, and other companies interested in the same services?

- What happens to the technicians that are not hired by the company that originally signed the agreement? And are those that are incorporated employed as technicians or as skilled labourers?

  In the case of the Lazaro Cardenas agreement between CONALEP and NKS, one must remember that although a very large number of workers could be absorbed by this company (2,000 including skilled and non-skilled workers, professional, technical, administrative and managerial personnel), it is obviously not possible for it to absorb the increasingly large number of graduates that are being produced by CONALEP. As this school is of the terminal type, the graduates must go directly into the labour market, and it would be interesting to look into what happens there, since the supply of people with this type of qualification is becoming fairly abundant. The post probable outcome of this situation is a tendency for training to become insufficient as the requirements of the employer increase.

The details concerning the professional technicians trained by CONALEP in Lazaro Cardenas together with the study programmes for other courses and the availability of these professionals in the states of Guerrero and Michoacan are to be found later in this chapter.

Higher education: in the concurbation there are no institutes for higher education. Those students who wish to further their studies do so elsewhere. The university closest to Lazaro Cardenas, which may be considered as being within a more extended region, is Michoacan University in Morelia, and Regional Technological Institutes in the same city. Considering forecasts of population increase and the expected complexity of the productive processes at the industrial and tourist centres, the creation of universities in Lazaro

Cardenas and Zihuatenejo will be a short-term necessity. At present there is the idea of forming branches of Michoacan University that will provide training in metalurgic engineering and marine science. However, we do not know whether or not these ideas have taken shape as definite plans.

Establishements for higher learning would not in fact be compatible with the middle-level education centres, whose courses are terminal, and in which the large majority of the students in the higher middle-level courses are enrolled, especially in Lazaro Cardenas.

In Chapter 7 we shall discuss the types of specialization required for the industrialization programmes in the region, as well as the availability of educated workers in areas of increasing importance.

3. Training facilities

Formal training programmes in the conurbation are limited to a few that have arisen as a result of the population expansion of the last ten years and the ensuing demand for trained personnel. In Ixtapa-Zihuatanejo there are a number of private training institutions in the service sector, such as secretarial schools, less formal courses for beauticians, dressmakers, etc., and others for developing talents such as piano, dancing, etc. Schools offering non-degree courses are in the service sector, as we have seen - technological schools where emphasis is on secretarial, accounting, commercial drawing, port technology, etc. The only enterprise of any standing, the Lazaro Cardenas iron and steel plant, which is the industrial nucleus of the whole area, has a workers' training centre. Unfortunately we did not have access to the plant and were unable to carry out interviews. However, during the implementation stage, in about mid-1973, personnel training programmes for all levels were offered by a consulting agency, the British Steel Corporation. Three years prior to the initiation of plant operations, the personnel training scheme consisted of two levels:

- Higher-level administration personnel (managers, administrative assistants, commercial cadre, operations and maintenance management, etc.) who began their training in Great Britain at the British Steel Corporation complex in admiistrative problems pertaining to the steel industry, as well as in managerial techniques. Courses lasted for five months, to sixteen people selected from a group of 400 technicians and administrative staff of the company. Managerial personnel were sent to AHMSA companies and Pena Colorada to become fully qualified.

- Mid-level technicians and skilled labourers: at a cost of 70 million 1975 pesos (partly financed with £230,000) a training centre was built on the site of the iron and steel complex for graduates of technical schools and for labourers with or without previous experience in steel manufacturing. The programme began with three-year courses for 225 students in electricity, metal working and mechanics. The first class began in 1974, and a second group of 250 started in February 1974. All students received full grants which included food, lodging and cash equivalent to half the minimum wage in the first year, 75% in the second year and 100% in the third. Courses were theoretical during the first two years and practical during the third. The professors were technicians trained at CENETI (the National Industrial Technological Centre), plus six English technicians. The workshops and laboratories were well-equipped, and were used not only for teaching but for normal iron and steel activities. We understand that at the present time these three-year courses have been suspended and the training centre caters to new staff in short courses of no more than twelve months' duration.

In a new city such as Lazaro Cardenas, with a mainly migrant population, one of the most serious problems is personnel turnover. The crisis of 1976 partly explains the fact that turnover in that year was so great (42% non-unionized personnel and 39% unionized). Shortages of qualified personnel made it possible to train replacements only through crash training courses while the factory was operating, mainly on the job. Obviously there were problems with operations and efficiency, particularly delicate operations such as continuous tapping or blast furnace. The training of workers and administrative staff is relatively fast, and based on practical rather than theoretical principles.

Turnover is still a problem, but not to the same extent as in 1976. The new staff had higher educational qualifications than the original staff had, which in itself facilitated training. Moreover the technological school graduates contributed to the training of the large mass of trained workers which would be necessary when the second stage of the SITCARSA operations and those of NKS and TUM began - all related, as we know, to the steel industry.

The personnel training strategy for the industrial port was similar. High-level personnel was trained at some of the most important industrial ports in the world, such as Oakland, the Hague, etc., and experts from Oakland came to Lazaro Cardenas to training intermediate staff. A large training centre is being built at the industrial port and plans include the use of training facilities for local, national and foreign candidates.

Both PEMEX and the construction industry have highly organized national training schemes. Petroleos Mexicanos' training programmes are coordinated with the Mexican Petroleum Institute (IMP, which has representatives in the most important refineries) and various training commissions (unions or company administration). Depending on the requirements of each working centre, training is given in any of 34 specializations which range from techniques and procedures for control instruments and electronics to machine tools, hospital management, accounting, etc. The minimum duration of the course is 90 days for technical staff and unionized professionals, and the trainees receive wages which in 1977 amounted to 11,000 pesos for technicians and 15,000 pesos for professionals. A minimum of 80% attendance at classes is obligatory; marks are from 0 to 10, and 6 is the minimum passing grade. Workers trained by PEMEX in 1981 are plotted in Table A.6.3 in the Appendix to Chapter 6.

The Fertimex training programmes are co-ordinated by PEMEX. We were unable to obtain information on the occupational organization of the Fertimex plant in Lazaro Cardenas, but we do have information regarding that of the Coatzacoalcos unit as well as the training courses given there during 1981. This information appears in Table A.6.4 in the Appendix to Chapter 6. Tables A.6.5-11 give supplementary information about people in functions, occupational fields and training programmes in CONALEP.

A complete list of key training facilities should include not only those in the town of Lazaro Cardenas, but also those of a wider area, which in this case should include all of the state of Michoacan. In Morelia, the capital, the San Nicolas Hidalgo University provides courses in engineering (civil, electrical, mechanical, industrial and chemical), and agronomy, and degrees in administration and public accounting, all of which are essential to the industry development of Lazaro Cardenas. There is also a regional technological institute in Morelia, where a degree course in industrial engineering is provided. Two private institutions, Cultural Don Vasco and Superior Vasco de Quiroga, offer degree courses in adminstration and public accounting. The Regional Technological Institute in Jiquilpan, offers courses in industrial engineering and public accounting. There are a number of technological centres plus a CONALEP school for technicians (with a complete upper middle-level programme and a Centre for Scientific and Technological Studies (CECYT), which is not completed, but offers special courses in wood and heavy construction, topography, electromechanics, electricity and auxiliary accounting. CONALEP centres in Michoacan, in Uruapan, Patzcuaro, Morelia, Zacapu, Zamora and Lazaro Cardenas, offer courses in urban construction (in Morelia and Zamora), electrical/mechanical maintenance, productivity, agriculture or "sea farming", hotel management and catering, and meat preservation. Perhaps we should add to these the CONALEP centre in the state of Guerrero, comprised of eight colleges, which prepares the following specialists:

- in Administration
  - assistant executive
  - accountant (fiscal)
  - accountant (warehousing and inventory)
- in Agro-industry
  - specialists in the preservation of agro-industrial products
    (fruit and vegetables)
    (cereals)
- in Urban Construction
- in Industry
  - electrical/mechanical maintenance
  - productivity
- in Medicine
  - nursing
  - community health
- in Mining
  - internal combustion engines and hydropneumatic systems for mines
- in Tourism
  - hotel management and catering
  - electrical/mechanical maintenance.

These last specialized courses are offered in Zihuatanejo, and most of them are designed to supplement the facilities provided by the Social Security Institute which trains the same specialists in the hotel industry, but this in only 100-hour courses.

4. Synthesis

Lately, the training facilities for the urban sector have operated in a fairly pragmatic manner, not only in informal but also in formal education systems. At the executive level, training is usually obtained abroad, in the industry's factories or companies, or with partners or consultants involved in setting up the projects. Technical and professional mid-level personnel can be trained in Mexico, sometimes by foreign technicians from the parent factory, but usually by local technicians. Training requirements, job characteristics and skilled-labour requirements are usually established prior to start-up of factory operations, making it possible to plan and establish systems which facilitate routine operation and maintenance tasks in the company. The levels of education in the conurbation and the adjacent regions have increased over time, which also makes local training easier. One of the main hindrances to training was the high degree of illiteracy and the inadequacy of instruction, which make it necessary to teach potential candidates to read and write before training could begin.

The high rates of turnover of personnel at all levels in SICARTSA affected the volume and quality of production, denoting the inherent instability of the company as well as that of the community where, as we saw, even basic living conveniences are non-existent and high temperatures make the presence of cool living quarters and surroundings essential. The lack of green areas, such as parks and plazas, the need to travel more than 10 kilometres to enjoy the beaches of a city built on the seashore, inflation, and the absence of recreational facilities are probably some of the factors that affect the length of time people spend in these towns, especially those who are highly qualified and can find jobs in more livable cities.

The lack of universities and institutes of higher learning make it necessary for personnel to be brought in from outside the region. As far as we know, there are no innovative activities of any kind within the conurbation other than those having to do with solving the elementary operation and maintenance problems required for the smooth running of the plants. This problem will be discussed in greater detail in Chapter 7.

Chapter 7: THE MICRO-REGION OF LAZARO CARDENAS: ESTIMATES OF HUMAN RESOURCE DEMAND

1. General considerations

Of the multiple factors to consider in estimating the demand for human resources in coming years, perhaps five are the most relevant to the quantitative determination of this demand:

1. the dynamics of industrial growth;
2. the magnitude of the works and the investment to be made;
3. the type of technology and the productivity of the industries installed in the micro-region;
4. the volume of total population and the levels of urbanization;
5. the employment structure.

The dynamics of industrial growth and the actual potential of a development centre being transformed to attract population and economic activites, to generate supply and demand of goods and services, in short, to develop the capacity for self-sustained growth and generation of new industries, depend mainly on processes and decisions of a political and economic nature, primarily occurring outside the region in national and international centres - often in countries depended upon to provide input and capital and to receive exported goods.

Present-day problems of contracting international markets, the decline in oil prices, the enormous volume of the Mexican foreign debt, and the general semi-paralysis of public investment in large works, severely affect the dynamics of sustained growth in a micro-region such as that of Lazaro Cardenas, which in spite of everything, is beginning to show its own impetus, little affected by the country's overall crisis. Thus the Second Stage of SICARTSA, at a cost estimated at around 73,000 million pesos (1980), has been authorized, and its construction is so advanced that by 1985 it will be producing a considerable volume of sheet steel. Productora Mexican de Tubos (with investments of around 7,000 million pesos) and NKS (with an investment of 6,500 million) began operating towards the end of 1984; the CONASUPO silos, with a storage capacity of 80,000 tons costing 17,000 million pesos, are finished, as are the roll-off/roll-on systems. Fertimex, with investments of 17,000 million pesos, also began operations at the end of 1983. The Industrial Port is virtually completed. All of these companies were generating permanent jobs for 19,000 people, including technicians, professionals, labourers, and administrative personnel, by the end of 1982.

SICARTSA and the Industrial Port in particular, but all of the abovementioned companies, will continue to generate jobs in construction, which is the most effective job-generating sector, especially for unskilled labour, but the medium-term rate of job increase in this industry will be affected by delays in start-up of important projects already identified. Among them are:

- the distribution terminal, especially the PEMEX Refinery (investment not estimated), which has faced opposition not only from the investment but from the technical point of view;
- Astilleros Unidos Mexicanos (investment estimated in 1981 at some 8,000 million pesos). This industry is very high technology and generates high-technology employment; it depends on inputs from the steel industry and appears closely related to the activities of the SIDERMEX, NKS steel complex, and others;
- CELASA, builders of a large volume of maritime towers for oil perforation, also a high technology fields, with investments on the order of 2,500 million pesos, not a large direct producer of jobs but a fairly effective indirect producer;
- POLIFOS, S.A. (estimated investment of 3,500 million pesos) related to the chemical industry;
- Transportes Maritimos Mexicanos (investment around 1,500 million pesos);
- Cementos Anahuac (unestimated investment) whose storage silos for cement would be essential to the development of a set of industries for which technological and feasibility studies have been completed.

In 1981 it was estimated that these industries would begin plant construction in 1983. Given the economic crisis, we do not know their short-range plans. Except for steel, growth in Fertimex and in the other industries mentioned as already existing in the industrial park of the port, would depend on the supply and demand situation and on possibilities of investment not foreseen when the projects were begun. Since all the companies are to a large extent interdependent as concerns production and input-output relations, it is likely that in the short run the expected problem of having to import sheet steel for the operations of NKS and PMT, was transformed into somewhat more complex problems, which would affect the volume of production of laminated steel, just to mention one example. We mention these possibilities because they will undoubtedly affect the resource estimates quantitatively, if not qualitatively.

Also of importance is continuity in investment in the Industrial Port, planned to grow considerably from 1986 on, especially in the Urban and Social Planning Concept. The data in Table 57 itemize the investment proposed for the industrial port from 1983 to 2000, and because of their value in generating construction jobs, we detail the goals of investment in Urban and Social Planning as well as those of industrial urbanization.

2. Overall demand for the zone

The demand for human resources in the micro-region or the Conurbation, while dependent on the activities of the Industrial Port, will also vary with activities generated outside the port projects and be directly or indirectly-connected with them. For the mere fact of having a population whose volume in the next seven years is conservatively estimated at 228,000 inhabitants (and more optimistically at 591,000), with 95% living in localities of more than 20,000 inhabitants, a demand for goods and services will be generated, requiring university graduates, middle-level technicians, skilled and unskilled labourers and clerks. Only at the levels of trade and informal activities is there activity which does and will serve as a very dynamic mechanism for generating jobs.

Under these conditions, the structure of demand by sector of the economy in the micro-region will show a secondary sector of absorption average quite a bit higher than the national averages. Of the new jobs that will be created in the medium range on the national level, the primary sector will absorb less than 10%, while the secondary and tertiary sectors will absorb 40% and 60% respectively. On the level of the Conurbation, for which estimates have been made, the expectations of the industrial port theorists for 1990 are that the primary sector will absorb 28% of the economically-active population, the secondary 32% and the teriary 40%. In the micro-region and the Conurbation, the primary sector of the economy - especially in the agricultural branches - should be able to generate few jobs because of the problems of

Table 57 - Proposed investment in the Lazaro Cardenas Industrial Port

Concept	1983	1984	1985	1986	1987	1988	1980-2000
	(in millions of pesos)						
Port infrastructure	448	448	448	448	448	488	5 263
Multi purpose terminal	100	100	100	716	716	716	
Supplementary construction	182	182	182	-	-	-	
Industrial urbanization	493	493	493	187	187	187	
Social and urban planning	1 190	1 421	1 422	7 724	7 724	7 724	34 538
Total	2 413	2 644	2 645	9 075	9 075	9 075	

Given their importance and impact on construction jobs, the last two concepts are broken down as follows:

Table 57(a) - Proposed investment in industrial urbanization

Concept	1983	1984	1985	1986	1987	1988
	(in millions of pesos)					
Studies and projects	25	25	25	8	8	8
Peripheral boulevard (28 km)	93	93	93	60	60	60
Distribution network for untreated water (22 km)	40	40	40	20	20	20
Storm sewers (22 km)	34	34	34	14	14	14
Industrial sewers (22 km)	45	45	45	20	20	20
Electricity and street lighting	45	45	45	20	20	20
Signs and landscaping	6	6	6	3	3	3
Secondary roads (15 km)	50	50	50	-	-	-
General services buildings	5	5	5	7	7	7
Sewage water treatment plant	8	8	8	7	7	7
Drinking water treatment plant	17	17	17	-	-	-
Specific urbanization (155 ha)	125	125	125	31	31	31
Total	493	493	493	190	190	190

Table 57(b) - Proposed investment in urban and social planning

Concept	1983	1984	1985	1986	1987	1988	1980-2000
	(in millions of pesos)						
Land development for housing (979 ha.)	-	-	-	81	81	81	388.0
Drinking water	-	-	-	13	13	13	62.3
Sewage system	-	-	-	15	15	15	71.8
Housing	1 160	1 384	1 384	7 565	7 565	7 565	33 056.0
General administration	30	37	38	50	50	50	950.0
Total	1 190	1 421	1 422	7 724	7 724	7 724	34 538.1

competition for the land and its use for urban activities. In the Conurbation as a whole, with the exception of the poles, primary activities will continue to be dominant, but have little capacity to generate jobs. We have already stressed in Chapter 5 that the CONAPO hypotheses - historical, programatic, and industrial port - are very optimistic regarding the generation of jobs by the primary sector. The impetus that would have to be felt throughout the Conurbation, according to the industrial port hypothesis, to provide employment to 165,000 persons would have to be extreme, and given the conditions of the soil, the scarcity of fertile land, the prevailing attitudes, and the present tendencies of the population toward emigration, we see this kind of development as being very unlikely. As a simple matter of conjecture it could be said that of every 10 jobs generated, 5 will be in the tertiary sector, 4 in the secondary, and 1 in the primary.

The education systems of the micro-region and the Conurbation will generate a demand for teachers, administrators, and specialized personnel. The potential demand for education in the years 1990 and 2000, according to the historical and industrial port hypotheses, should be as shown in Table 58.

Table 58 - Potential number of students, 1990 and 2000

Age	Historical Hypothesis		Industrial Port Hypothesis	
	1990	2000	1990	2000
Conurbation				
5-14	74 575	141 723	127 073	292 732
15-19	42 732	41 727	102 653	177 177
20-24	42 700	45 846	108 465	226 015
Micro-region				
5-14	41 455	104 328	95 963	227 320
15-19	29 935	27 336	91 526	161 925
20-24	31 724	33 765	100 212	209 516

A rapid calculation of the demand for primary-school teachers and for professors for the lower- and upper-middle levels may be the following: at the primary levels we estimate 25 students per teacher in the 6- to 11-year-old population. At the middle level, we consider the 12- to 17-year-old population, estimating that by 1990 and 2000 the lower middle level should satisfy the entire demand, and the upper middle level half of the demand. We estimate the number of students per teacher at 50. In the short run, more precise methods must be conceived to predict the demand for teachers, those completed to date refer specifically to the demands of the industrial sector.

Two estimates of demand for teachers and professors in the Conurbation are shown in Table 59:

Table 59 - Potential number of teachers, 1990 and 2000

Teachers	Historical Hypothesis		Industrial Port Hypothesis	
	1990	2000	1990	2000
Primary	1 800	3 500	2 800	7 000
Lower and Upper Middle	800	1 050	1 550	2 850

To these estimates it would of course be necessary to add the demand for teachers on the pre-primary level, which would increase as the population urbanizes.

Quantitative growth in the demand for professionals in the micro-region and the Conurbation would depend on social demands and on the demands generated by the technical division of labour. The two are closely related, and depend on a set of objective and subjective factors from the differentiated levels of salaries to such conditions as the degree or urbanization, the dynamism in the professional market, the government's strategies of educational supply, and other power-related factors. On the level of the country as a whole, the income levels and job markets of professionals (university graduates) have been much more elastic than those of other occupational groups; the historical tendency has been sustained growth in enrolment in professional studies, to include increasing percentages of the demand (approximately 13% nation-wide, but around 20% and more in the highly urbanized regions).

In the Conurbation and the micro-region, the demand for professionals has been covered until now by immigrants. It is unlikely, however, that the volume of local population foreseen for 1990-2000 will permit importation of professional personnel. The pressures of social and general demand for upper-level educational institutions will be very heavy. If, as the industrial port population estimates indicate, the rate of penetration of the 21- 24-year-old population were around 20% in 1990 and 2000, there would be some 22,000 youths in 1990 and around 67,000 in 2000 ready to enrol in professional studies.

The demand for professionals will thus be strongly concentrated in the secondary and tertiary sectors, and the tendencies in the country as a whole indicate an intensification of the concentration of professionals in the tertiary sector, whereas in 1970 this sector had 60% of the professionals, by 1980 the figures had risen to 78%. At the same absorption in the secondary sector decreased from 36% to 20% and in the primary sector from 4% to 2%. Accentuated urbanization and explosive industrial development such as that taking place in the micro-region do not perhaps lead to a short-term process of such intense over-tertiarization, and balances between the employment of professionals would be improved.

The health sector will incorporate a great many doctors, biochemists, pharmacists, etc. At present in the micro-region the three hospitals have only 53 MDs; fewer than 1 for every 1,000 social security beneficiaries, and 1 for every 2,000 inhabitants. In 10 to 20 years, the supply of services should be more efficient; a gross estimate of 1 doctor per 700 inhabitants in the Conurbation would mean a minimum of 500 doctors by 1990, according to the historical hypothesis, and 780 by 2000. The industrial port hypothesis sets the requirements at 970 by 1990, 2,400 by 2000. To maintain the present ratios in the clinics, a number of paramedical personnel would have to be added - nurses, laboratory technicians, etc.

3. Nationwide supply and demand for professionals

On national and state levels the Ministry of Public Education (see Mexico, 1982) has calculated estimates of supply and demand that, although they have serious problems of overestimation of demand (mainly due to the use of very optimistic estimates of economic growth), are useful in visualizing some of the tendencies to which greater attention should be paid, related to both the 'deformations' on the supply and demand level, and to the qualitative problems that seem to overwhelm the school system on the upper levels. Some of the calculations appear in Table A.7.1 of Appendix to Chapter 7. On the national level, in 1980, the total demand for professionals was greater than the supply by almost 60,000 persons, the largest shortage being in the tertiary sector, and especially in the public sector. Shortages were also observed in the secondary sector, especially in processing industry. Mexican agriculture continues to be traditional on the whole, and the demand for professionals that it generates is minimal, in both absolute and relative terms.

However, as we have seen in Chapter 2, tendencies in the upper-level educational supply overtake demand, at least within the schemes, means, and procedures of the productive and service apparatuses. The SEP calculations would indicate a surplus of professionals by 1990, of almost the same number as the shortage observed in 1980 (55,000). However, when analyzed by sector and branch, demand from the processing industries will continue to show deficits, growing from 3,000 professionals in 1980 to 10,000 in 1990.

Descriptions by economic sector and activity of all 118 careers analyzed by the SEP would of course be impossible to include here. The following selection of data based on deficit and oversupply figures for 1980, extrapolated to 1992, will give an indication of the scope of the work (for further details see Table A.7.1 in the Appendix to Chapter 7).

Primary sector

1) Agriculture: overall, this sector will have a surplus of some 5,000 professionals in 1990. The calculations would indicate a lack of agronomists (around 4,600) and edaphologists (300); but in the other careers the following changes are predicted:
   - from a 1980 shortage of phytotechnologists (1,600), there will be a surplus of some 5,000 in 1992;
   - from a 1980 shortage of agroparasitologists (179), there will be a surplus of 2,850 in 1992;
   - from a 1980 shortage of 100 fruiticulturists, there will be a surplus of 1,000 in 1992.
2) Livestock: from a shortage of some 600 professionals in 1980, there will be an enormous oversupply of around 19,000 (17,600 in zootechny and veterinary science, and 1,400 in fodder).
3) Fishing: from a shortage of 120 professionals in 1980, there will be a surplus of 2,400, mostly in marine biology.
4) Rural development and administration: from a small shortage of 160 persons in 1980, there will be an oversupply of 3,200. In the Rural Development specialty alone a surplus of 500 professionals is estimated by 1992.

5) Extraction: the mining and matallurgy sector will have a general shortage of professionals estimated at around 2,200, half in mining and a good proportion in geology. On the other hand, the petroleum sector will have a surplus of 1,300 professionals over the estimated demand for 2,600.

Overall shortages in the Primary Sector are estimated only in the mining and metallurgy sector, and these are partially compensated by the estimated surplus in the petroleum sector. In the agriculture and livestock sector, however, the SEP estimations indicate that the oversupply of professionals will be equivalent to more than half the surplus of professionals in the entire economy (29,600 out of 55,000).

Secondary sector

We will divide this sector into the construction, electricity, and processing industries.

Construction: from a surplus in the supply of professionals in this branch, there will be a shortage of around 8,300 engineers by 1992 - civil (13,600), public works (15,100), communication (5,800), and hydraulic engineers (2,100) - partly offset by a surplus of 25,600 urban engineers and 2,800 rural engineers.

Electricity: this is a relatively balanced sector, since the over-supply will exceed the demand only by 845 professionals, administrative included.

Processing industries: from a deficit of 3,000 observed in 1980, it is estimated that there will be an even greater shortage - about 10,000 professionals - by 1992. The greatest shortfalls are predicted in chemicals, which could reach around 9,000 and electromechanical engineering, 11,600 and in mechanical engineering 2,800. In industrial administration a surplus of 6,900 is expected and in food processing 2,000.

In synthesis: in the secondary sector it is predicted that the deficits observed in 1980 will continue to worsen in absolute terms to 1992, when the deficit will reach 18,500 professionals, especially in the branches of engineering. Of this total deficit, 10,000 will come from the Processing Industry and 8,300 from the Construction Industry.

Tertiary sector

For their particular interest to us, we shall select certain branches in this sector:

Transportation: a surplus of 1,100 engineers is predicted.

Commerce: from a 1980 deficit of some 16,000 accountants, there will be a 1992 shortage of around 77,000 (34% of the demand).

Other Private Services: administration will probably have a deficit of 9,300 persons by 1992, Personnel Administration one of 5,400, Communication Sciences one of 12,600.

Public Administration: for this branch there will be a total surplus of some 26,700 professionals. Divided by careers, the greatest over-supply will be of lawyers (35,600), actuaries (2,700), graduates in International relations and foreign trade (2,000). On the other hand, there will be deficits in graduates in public policy and administration (9,500) and in economics (4,300).

Health: an overall surplus of some 12,500 professionals is predicted, of which the most noteworthy are in clinical analytical biology (almost 11,000, half the demand) and clinical psychology (4,000). It is interesting to observe that in medicine, from a surplus in 1980 of around 7,500 doctors, there will be a deficit of around 10,500 in 1992. The observation is relevant because the medical schools in the country are at present limiting access in the expectation of an over-supply.

Education: in general, a large surplus of primary-school teachers (86,000) is predicted, along with deficits at the upper-middle and upper levels. By specialization, the following shortfalls are predicted: educational psychology in primary schools (4,000); teaching and research in physics (7,400), mathematics (3,800), physics and geophysical engineering (1,200), history (13,000), languages (7,000), anthropology (3,500), geography and oceanography (800). Surpluses are predicted in sociology (1,900) and philosophy (3,400).

In summary: serious deficits are foressen in the supply of public and private accountants, economists, researchers at the middle and upper levels of education, the shortfalls in the sector will be some 140,000 professionals. However, this deficit is counterbalanced by the surpluses in the sector, especially in primary-school teachers, lawyers, clinical analysis biologists, and some social scientists, altogether adding up to 155,000 persons.

Although we emphasize that some of these predictions are debatable, taking as a reference the estimations for the nation and the Conurbation, we see that it is precisely in the professions that will be having the greatest need for skilled personnel that the largest deficit problems are predicted. We refer especially to the branches of engineering, public administration, health, and post-primary education. But before elaborating on these, we shall analyze the human resource estimates undertaken in the industrial sector of the micro-region.

4. Human resources in the industrial sector of Lazaro Cardenas

As we have seen in the early sections of this work, contingencies in the investments planned for the Industrial Port make shortand medium-term estimates of human resources in the micro-region problematic. The SEP Technical Committee on Human Resources in conjunction with the Ministry of Labour and Social Security estimated human resources for Lazaro Cardenas*. Following are some details of their estimates, followed by a qualitative discussion of some aspects. In estimating the demand for human resources various scenarios were considered, in a system characterized as 'severely stochastic and indeterminate', since prognosis is affected by scarcity and unreliability of information, and uncertainty of continuity in investments and the evolution of productivity in the region.

With respect to the establishment of new industries, the analysts worked from two hypotheses:

Low hypothesis: a pessimistic or conservative estimate of the establishment of new industries, which considers exclusively the investments that are identified and their possible growth. From what is actually happening, the pessimistic hypothesis has become the realistic or more reliable one, at least in the short run.

High hypothesis: the optimistic view considers that in addition to the industries already identified, it is plausible and probable (or plausible given the expectations of the results of economies of scales, intensification of activities around parent industries - steel, petrochemicals, food, cement, etc.) that others will be attracted.

Estimates were also distinguished on the basis of two possible evaluations - constant and variable productivity.

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* Comité Técnico de Planificacion de Recursos Humanos: Analisis de los Requerimientos de Recursos Humanos para el proyecto del Distrito Industrial Marino en Lazaro Cardenas, SPE/STPS, Mexico, 1980.

The micro-region of Lazaro Cardenas: estimates of human resource demand

Increases in productivity give rise to quantitative and qualitative changes in employment. Quantitatively, for a fixed level of production, at higher levels of productivity, fewer employees are required per unit. The qualitative aspect is more closely related to education in the sense that when increases in productivity result in the application of more sophisticated and capital-intensive technologies, the general tendency in the occupational structure is toward employing more technicians and university graduates and less unskilled labour.

- At constant productivity, (a) the more reliable methods of the two used was to solicit information from the identified industries concerning total needs in human resources broken down by occupation, the occupations considered to be essential to the achievement of the company's objectives, training plans, and development expectations; (b) the comparative method compared occupation structures in other countries and disaggregated the total number of jobs through calculations of regression equations.
- where productivity is variable (a) the total of direct jobs and of jobs broken down by group are calculated; (b) elasticities and growth rates are introduced with the equations.

Occupational groupings were based on similarity and/or substitution between occupations, and on the educational levels required. General occupational groups were the following:

- Professionals: those that have completed university education or post-graduate studies;
- Middle-level technicians: those that have completed technical studies, or begun but not finished the licenciatura;
- Skilled workers: those having a certain level of formal education and/or training specifically for the job;
- Unskilled workers: those that have minimal formal education and required crash courses to qualify for the job.

The Tinbergen-Correa methodologies of input-output were used to calculate the number of persons on each educational level through linear equations, and the method of Becherman-Parnes, which is more comprehensive in considering social objectives.

Personnel demand estimates were broken down by industry - construction, steel, manufacturing of steel products, fertilizers, CONASUPO, port administration and operation, and others. The accumulated demand for resources, also by industry, is estimated for 1982, 1985, 1990 and 1992.

a) Construction

The 1982-2000 programme of investment in Construction and the generation of jobs by type of work appears in Table 60. It is seen that, except for minor fluctuations from one year to the next, the generation of jobs expected by the volume of construction grows from 21,580 in 1982 to a maximum of almost 40,000 in 1999. The yearly figures are given in Table 61.

Technicians and engineers make up around 5% of the total employed in the construction industry, and considering the experience accumulated in the micro-region, as well as the qualification systems in industry, there should be no major problems, even though on the national level it is estimated that there will be shortages of civil and public works engineers. Of the total demand, industrial construction and assembly, housing construction, classrooms, and the health infrastructure make up the greatest demand for technicians and engineers, especially civil, mechanical, and electrical engineers, and it is in this area that the Regional Technological Institutes and universities - both in the region and throughout the country - should make special efforts.

In the short term, almost 70%, and in the medium term 37%, of the jobs that will be generated in the micro-region will be in the construction industry; it is thus a good idea to specify in detail the demand for human resources that was researched by the Technical Committee consultants, for professionals, middle-level technicians, and skilled workers, by type of construction. The data appears in Tables A.7.2-10 in the Appendix to Chapter 7.

b) Steel industry

Here we consider not only the Lazaro Cardenas-Las Truchas steel mill as a parent company, but also those that depend on it, such as NKS, PMT, CELASA, etc. The steel mill, as we have previously seen, produces steel at present in the form of rods and contours in a volume of approximately 1.5 million tons, based on a blast-furnace foundering technology. Construction of the second stage, planned to commence operations in 1985, is based on a different technology: that of electric oven-direct reduction, which is capital-intensive and has an estimated productivity of soft steel twice as great as that of the first stage. The figure used in analysis to calculate human resources is 400 tons per employee (compared to 200 tons in the first stage), a figure sometimes comparable to the steel productivity average in the United States (1977).

Table 60: Programme for public investment in construction; by type of work and annual demand for human resources, at constant productivity, Lazaro Cardenas, Mich.

Year	Industrial port infrst.		Urban indst. infrst.		Services		Health, class-rooms & housing		Construct. indust.	Total	3rd Stage Sicartsa	Total	4th Stage Sicartsa	Total
	Invest.	Demand	Invest.	Demand	Invest.	Demand	Invest.	Demand	Demand	Demand		Demand		Demand
1982	987	1 091	1 242	2 052	205	547	4 426	13 618	4 269	21 577	---	21 577	---	21 577
1983	942	1 041	1 242	2 052	342	912	3 674	11 305	12 017	27 327	---	27 327	---	27 327
1984	314	347	1 242	2 052	342	912	3 983	12 255	15 382	30 948	---	30 948	---	30 948
1985	90	99	1 242	2 052	342	912	322	991	21 300	25 354	---	25 354	---	25 354
1986	584	645	814	1 345	185	493	2 338	7 194	12 609	22 286	---	22 286	--	22 286
1987	584	645	814	1 345	185	493	2 322	7 422	8 500	18 405	---	18 405	---	18 405
1988	723	799	814	1 345	185	493	2 756	8 480	8 199	19 316	---	19 316	---	19 316
1989	361	399	814	1 345	185	493	2 923	8 994	7 422	18 653	672	19 325	---	19 325
1990	528	583	814	1 345	185	493	3 046	9 372	1 958	12 852	6 000	18 852	---	18 852
1991	524	579	462	763	77	205	---	---	1 216	5 065	14 920	19 985	---	19 985
1992	1 083	1 197	462	763	77	205	84	258	1 396	3 819	20 770	24 589	---	24 589
1993	594	656	462	763	77	205	2 204	6 782	1 558	9 964	12 000	21 964	---	23 485
1994	1 188	1 313	462	763	77	205	5 010	15 415	1 739	19 435	5 800	25 235	---	25 235
1995	105	116	462	763	77	205	5 105	15 708	7 360	24 152	---	25 152	---	24 152
1996	1 157	1 278	558	922	173	461	6 847	21 068	2 166	25 895	---	25 059	---	25 059
1997	524	579	558	922	173	461	7 265	22 354	2 418	26 734	---	25 745	672	24 617
1998	492	544	558	922	173	461	6 597	20 298	2 698	24 923	---	23 759	6 000	29 759
1999	---	---	558	922	173	461	7 067	21 745	3 012	26 140	--	24 776	14 920	39 696
2000	---	---	558	922	173	461	2 578	7 932	3 362	12 677	--	11 084	20 770	31 854

Source: Mexico, 1982

Table 61 - Increases in employment generated by the construction of the industrial port (from Table 60)

Year	Annual accumulated total demand	Difference
1982	21 580	-
1983	27 330	5 750
1984	30 950	3 620
1985	25 350	-5 600
1986	22 290	-3 060
1987	18 400	-3 890
1988	19 320	920
1989	19 330	10
1990	18 850	- 480
1991	19 990	1 140
1992	24 590	4 600
1993	23 490	-1 100
1994	25 240	1 750
1995	24 150	1 090
1996	25 060	910
1997	26 420	1 360
1998	29 760	3 340
1999	39 700	9 940
2000	31 850	-7 850

Source: Mexico, 1982.

Since the SICARTSA calculations define productivity per person employed as productivity per person actually producing, the productivity would in fact reach 445 tons per person. The analysts defend these increments in expected productivity of SICARTSA, which are 13% higher than productivity in the United States industry, on the basis that in the USA steel production is the result of a combination of technologies, while SICARTSA's second stage represents one very modern technology. Based on production and productivity, the total number of personnel required was calculated, utilizing occupational structures from other countries where the technology of direct reduction is widespread, and then broken down into the four categories that require different qualifications. The calculations of the demand for professionals, mid-level technicians, and skilled workers, appear in Tables A.7.11-13 in the Appendix to Chapter 7. Table 62 shows the calculations of accumulated demand for the years 1985, 1990 and 2000.

Table 62 - Steel - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1982		1985		1990		2000	
	L (1)	H (2)	L	H	L	H	L	H
Professionals	-	-	320	338	1 200	1 442	2 402	2 904
- Science and engineering	-	-	160	169	600	721	1 201	1 452
- Administration and accounting	-	-	135	142	506	608	1 013	1 225
- Others	-	-	25	27	94	113	188	227
Mid-level technicians	-	-	250	264	938	1 127	1 877	2 269
- Technicians	-	-	98	104	369	444	739	894
- Administration assistants	-	-	152	160	569	683	1 138	1 375
Qualified personnel	-	-	3 920	4 135	14 699	17 663	29 432	35 579
- Skilled workers	-	-	3 475	3 666	13 030	15 657	26 090	31 540
- Office clerks	-	-	445	469	1 669	2 006	3 342	4 039
Unskilled workers	-	-	510	538	1 913	2 298	3 829	4 688
Total	-	-	5 000	5 275	18 750	22 530	37 540	45 360

(1) Low Hypothesis

(2) High Hypothesis

As can be observed, the volume of engineers (civil, mechanical, electrical, industrial, chemical and metallurgical) and of administrators and accountants required for the second stage alone will be quite significant for 1985 (between 320 and 340), increasing by 1990 to 1,200, and by 2000 to between 2,500 and 3,000, when the four stages of the complex are in operation. The ratio of engineers to administrators is almost one to one, and will remain so right up to 2000.

The number of mid-level technicians required will be somewhat lower than the number of professionals, to maintain a ratio of 1.5 administrative assistants to each technician in the engineering specializations. The requirements increase from 250 in the low hypothesis for 1985, to 916 for 1990, and 2,120 for 2000.

The great majority of employees in the company are skilled workers: metallurgists, mechanics and electricians, construction workers, port and vehicle operators make up the majority, to which is added in an approximate proportion of 11% the office administration clerks. Requirements in the low hypothesis increase from 4,000 in 1985 to some 15,000 in 1990, and 30,000 in 2000. The demand for unskilled workers will increase from around 500 in 1985 to 2,000 in 1990, to between 3,600 and 4,300 in the year 2000. Of each 100 jobs generated in the steel industry, 77 will be for skilled workers, 10 for unskilled workers, 7 for professionals and 6 for mid-level technicians. Discriminating more precisely between engineers and administrators, administrative assistants and technicians, workers and office clerks, we have the following breakdown:

Engineers, scientists and others	4
Administrators and accountants (univ. grad.)	3
Engineering technicians	2
Administrative assistants	4
Skilled workers	68
Office clerks	9
Unskilled workers	10

c) Steel-dependent industries

Here we include three industries, divided into two groups, for which the analysts did their estimations of resources separately: a) industries that produce capital goods, such as NKS and SELASA; and b) the manufacturing industry for steel products, PMT. NKS will produce - in installations capable of producing and managing ingots of up to 100 tons per unit, forged and cast pieces of up to 70 tons, and shaped sheet pieces of up to 300 tons - forged and cast elements for the manufacture of steam turbines, rollers, high-pressure containers, boilers, turbo-generators, shells for up of five workshops (steel foundry; casting; forging; boiler-making and machinery), plans to produce 93,000 tons of liquid steel, 20,000 tons of steel foundering, 20,000 tons of forging and 10,000 tons of heavy-pressure vessels. The steel workshop will have electric-arc furnaces of 30 and 15 tons, as well as a pre-warming oven for thermal treatment, etc. The forging shop will install the largest hydraulic press in the country (4,000 tons, capable of heating 6,000 tons and handling ingots of up to 100 tons); there will be another smaller press of 1,500 tons. The paileria shop will have sophisticated equipment for the production of components of up to 300 tons unit weight and 200 millimetres of sheet thickness, for products subject to high pressures and temperatures. The machine shop will have tooling machines such as horizontal lathes of up to 15,000 millimetres between centres, reborers of up to 8,000 mm, and 8,500 mm borers with transverse movement.

Construcciones y Equipos Latinoamericanos plans to produce between 40 and 60 ocean platforms for oil drilling, of approximate weights between 1,500 and 3,000 tons. Since the company has not yet begun the construction of its plant, we have few data.

Productora Mexicana de Tuberia (PMT) will produce large steel pipes, exterior diameter 16-48 inches, maximum thickness one inch, in lengths of 40 feet, at an initial production capacity of 400,000 tons. One of the latest technologies (a process of individual pressure and expansion - UOE production) will be used, with submerged-arc soldering using three electrodes.

Personnel estimates for the steel companies, plus a few related firms that will begin operating in 1990, appear in Table 63 broken down by occupational group. In connection with these high-technology companies involved in the production of capital goods, it is interesting to note:

- that the ratio of engineers to administrative personnel is 1:18, to skilled workers, 1:16, to engineerng technicians, 1:3. There are 1.16 administrative professionals and accountants for every administrative assistant, and 3.39 office employees for every professional;
- as in the steel industry per se, ratios in the steel-dependent industries tend to disprove the widespread belief that there are 4 or 5 technicians for each professional. As we have just seen, there are in fact more professionals that technicians. It must also be taken into account that the estimates have been made on the basis of data taken from countries already advanced in the same or similar

Table 63 - Capital goods and manufacturing of steel products - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1982		1985		1990		2000	
	L (1)	H (2)	L	H	L	H	L	H
Professionals	318	370	524	582	694	943	1 659	2 504
- Science and engineering	163	189	231	297	355	480	844	1 267
- Administration and accounting	136	159	193	251	298	408	722	1 097
- Others	19	22	28	34	41	55	93	140
Mid-level technicians	239	277	339	448	530	736	1 311	1 922
- Technicians	124	144	177	231	274	378	669	1 022
- Administration assistants	115	133	162	217	256	358	642	1 000
Qualified personnel	2 984	3 462	4 241	5 588	6 596	9 165	16 322	25 147
- Skilled workers	2 514	2 916	3 572	4 738	5 579	7 793	13 926	21 566
- Office clerks	470	546	669	850	1 017	1 372	2 396	3 581
Unskilled workers	139	161	198	257	300	319	741	1 129
Total	3 680	4 270	5 230	6 875	8 120	11 163	20 033	30 802

(1) Low Hypothesis

(2) High Hypothesis

technology, such as the United States, Canada, Belgium, etc. The ratio of engineering technicians to administrative technicians or assistants is 1:06, and for each engineering technician there are 20.5 skilled workers; in the case of administrative staff, the ratio is smaller: 3.9 office employees for each administrative assistant. There is here undoubtedly a great deal of confusion as regards the differentiations between technicians and skilled workers. This is especially the case on the level of the educational system, that tends to award titles (terminal and non-terminal) of 'technician', encouraging expectations that will not necessarily be fulfilled on the job. What is clear in the forcasts is that the necessity for skilled workers is much greater than that for technicians, at least as concerns the expected occupational possibilities;

- the characteristics of the companies that produce capital goods reflect, in comparison to steel manufacturing, the protential decreases in the absorbtion of unskilled workers. Whereas in 1990 in the steel mills (even with the most modern technology in the industry) 10 of every 100 employees will be unskilled workers, the optimistic ratios* foreseen for the capital goods industries in the year 1990 are as follows:

Professionals:	
- Engineers, scientists and others	5
- Administrators and accountants	4
Technicians:	
- Engineering technicians	3
- Administrative assistants	3
Skilled workers:	
- Skilled workers	69
- Office clerks	12
Unskilled workers:	4

d) Other industries

In the Industrial Port programmes (see Chapter 3) an extensive community of large industries related to those already there is expected to amalgamate - either to use their products or to provide input. As we have seen, a complex of associated companies sprang up around the cement manufacturing industry - glass, construction materials, lumber processing, plants for upgrading benzol and tar, solvent and paint factories, etc.

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* These ratios are optimistic estimates for 1985 taken from Table 63.

Perhaps one of the most important projects mentioned, given its high technological level and the complexity of its operations, is the establishment of a shipyard capable of constructing ships up to 120 metres in length; in its first stage it will be capable of repairing and constructing ships up to 80,000 tons, and, later, to 120,000 tons.

To our knowledge, none of these industries has as yet been authorized, or even planned so far as to estimate probable investment levels. Some are as yet nothing but empty spaces in the Industrial Park; no actual construction has begun, and it is possible that nothing very significant will be accomplished in the short term, and this state of affairs may seriously affect the impetus for growth and development of the Industrial Port and the already-implemented industries, which are largely dependent, as we have already mentioned, both on inputs and on product markets. The design of the port as a system of industrial complexes calculated on the basis of interactions between companies depends for optimal operation on the strategies of the parts affecting the whole. We earlier mentioned, for example, how the unavailability of steel plates would affect companies such as NKS and PMT; how PEMEX decisions would affect the industries in Fertimex, Fertimex decisions affect the NKS products such as ammonia convertors or urea reators, and shipbuilding would be affected by the availability of plate steel and boilers, etc.

Because of the great uncertainty regarding both the amount of investment and the types of technology, the determination of the key occupation and estimated quantities is very difficult, both on the level of total volumes and in the breakdown by type of employment. The hypotheses of the consultants were based on estimates similar to the previous ones, using for the breakdowns statistical information on employment profiles in manufacturing industries in other countries. As far as we know, they did important studies on the most important technologies both in cement manufacturing and in the making of construction materials. The shipbuilding occupational profiles were based on similar shipyards in other countries, and many of the estimates that appear in Table 64 and in the Tables A.7.14-16 in the Appendix to Chapter 7 depend heavily on this type of industry. Of the estimates made by these consultants, we do not include those for 1982, and it is very possible that those for 1985, 1990 and 2000 should be applied to later years.

Table 64 - Other industries - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1985		1990		2000	
	L (1)	H (2)	L	H	L	H
University graduates	177	292	312	514	969	1 599
- Sciencists and engineers	73	120	128	211	399	658
- Administration and accountants	68	113	121	199	375	618
- Others	36	59	63	104	195	323
Mid-level technicians	296	488	521	861	1 621	2 675
- Technicians	130	215	229	379	713	1 177
- Administrative assistants	166	273	292	482	908	1 498
Qualified personnel	2 672	4 408	4 709	7 770	14 626	24 134
- Skilled workers	2 286	3 771	4 026	6 648	12 513	20 648
- Office clerks	386	637	683	1 122	2 113	3 486
Unskilled workers	129	214	228	376	706	1 163
Total	3 274	5 402	5 770	9 521	17 922	29 571

(1) Low Hypothesis

(2) High Hypothesis

According to pessimistic estimates, at constant productivity, these industries should be generating, some 18,000 jobs by the year 2000, the majority of them again skilled workers. Ratios between various occupational groups are virtually the same as those observed in the capital goods enterprises, with the very significant difference that here the mid-level technicians are estimated at 1.8 for every engineer and the administrative assistants at 2.4 per administrator, that is, quite a bit closer to the widespread assumption of four technicians to each professional. At any rate skilled workers make up the greatest proportion of employment (70 of every 100 jobs).

e) FERTIMEX

This company plans a first stage of construction of seven industrial plants for the production of phosphorus and nitrogen fertilizers, as well as intermediate products to obtain fertilizing products (660,000 tons annually of sulphuric acid, 198 of phosphoric acid, 210 of nitric acid, 270,000 tons of liquid ammonium nitrate, 200,000 tons of solid ammonium nitrate, 270 of diammonic phosphate, 250 of NPK complex fertilizers). A second stage will double the production of sulphuric acid and phosphoric acids in NPK fertilizers, and a triple superphosphate production plant (436,000 tons annually) will be added. For the year 1990, in a third stage, plants will be installed to produce urea and nitrogen solutions, if PEMEX produces ammonia from natural gas.

Fertimex plans not only to make Mexico self-sufficient in the production of fertilizers, but to market a surplus internationally. Compared to earlier companies, Fertimex generates a good deal of employment, but the figures are not yet impressive. For the year 2000 it will provide jobs for some 2,400 persons, of which the majority will be skilled workers (67 skilled workers out of every 100 employees); the ratio of technicians to professionals as almost one to one (1.2 overall throughout the fertilizer industry), it being noteworthy in this company that the weight of technical professionals and engineers in relation to the administrative professionals is almost 5.4 to 1 among the professionals and 1.6 to 1 among the mid-level technicians. The ratio of professionals to skilled workers is much wider - 65 to 1 (see Table 65, and Tables A.7.17-19 in the Appendix to Chapter 7).

Table 65 - Fertilizer - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1982		1985		1990		2000	
	L (1)	H (2)	L	H	L	H	L	H
Professionals	60	63	60	63	120	126	180	188
- Sciencists and engineers	49	52	49	52	98	103	147	154
- Administration and accountants	9	9	9	9	18	19	27	28
- Others	2	2	2	2	4	4	6	6
Mid-level technicians	73	77	73	77	146	153	219	230
- Technicians	45	47	45	47	90	94	135	142
- Administrative assistants	28	30	28	30	56	59	84	88
Qualified personnel	528	554	528	554	1 056	1 108	1 584	1 663
- Skilled workers	520	546	520	546	1 040	1 091	1 560	1 638
- Office clerks	8	8	8	8	16	17	24	25
Unskilled workers	125	131	125	131	250	263	375	395
Total	786	825	786	825	1 572	1 650	2 358	2 476

(1) Low Hypothesis

(2) High Hypothesis

f) CONASUPO

CONASUPO is the centre of the agro-industrial complex, and of grain storage stations, loading and unloading. Eventually this complex should produce 99,000 tons each of salt, balanced food, corn flour, oils and animal fats, and wheat flour, 35,000 tons of packaged bread, 17,000 tons of biscuits and pasta, and 4,000 tons of soaps and detergents annually. The storage, loading, and unloading units will begin operating at the end of 1984. The dynamics of the CONASUPO industry is limited to that of related industries such as fruit canning, coconut, and sesame processing, manufacture of sweets, sausages, etc.

The key occupations here are related to industrial engineering and to agronomy, and the optimistic estimate of new employment for the year 2000 is around 2,500 jobs directly related to the company, of which the majority will be for skilled workers (64 out of every 100). In the professional branch there will be a ratio of two administrative and accounting positions to every engineering and scientific position, whereas among mid-level technicians, the ratio of administrative employees to technicians should be 3 to 1:

Professionals	
- Scientists, engineers, others	2
- Administration, accounting	4
Mid-level technicians	
- Technicians	1
- Administrative assistants	5
Skilled personnel	
- Skilled workers	64
- Office clerks	15
Unskilled workers	9

The detailed estimates appear in Table 66 and in Tables A.7.20-22 in the Appendix to Chapter 7.

g) Administration and operation of the industrial port

The technology employed for the handling of cargo - containers, and solid and liquid bulk - is a very modern roll-off roll-on system. This kind of capital-intensive technology is labour saving, especially with respect to longshoremen. The first stages of the port, already in operation, receive all kinds of cargo. Special attention is paid to labour relations on the ports. In the future estimates of human resources is included the personnel necessary for the administration of the industrial park, and that required for port operations by those companies with their own waterfront.

Table 66 - CONASUPO - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1982		1985		1990		2000	
	L (1)	H (2)	L	H	L	H	L	H
Professionals	-	-	35	41	55	63	132	150
- Scientists and engineers	-	-	10	12	16	18	38	43
- Administrative and accountants	-	-	21	25	33	38	79	90
- Others	-	-	4	4	6	7	15	17
Mid-level technicians	-	-	38	43	59	68	141	160
- Technicians	-	-	9	10	14	16	33	38
- Administrative assistants	-	-	29	33	45	52	108	122
Qualified personnel	-	-	470	540	729	842	1 756	1 995
- Skilled workers	-	-	382	439	593	684	1 427	1 621
- Office clerks	-	-	88	101	136	158	329	374
Unskilled workers	-	-	57	66	87	102	211	240
Total	-	-	600	690	930	1 075	2 240	2 545

(1) Low Hypothesis

(2) High Hypothesis

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As can be expected, key personnel is made up of engineers with knowledge of port operations, technicians in port administration and operation, and specialists in industrial relations. The operators of cranes and special cargo equipment constitute most of the skilled workers (see Table 67 and Tables A.7.23-25 in the Appendix to Chapter 7). Low and high estimates of jobs generated by port operations are 2,100 to 2,400. By 2000, the figures are 3,000 and 3,600 respectively.

In 1990, professionals will make up 6.4% of the labour force (low estimates) while technicians will represent 21.4% and workers 63.8%. The ratios of technicians to professionals, and of skilled workers to technicians, will be 3 to 1.

5. Synthesis

The complexity of the political and economic processes and phenomena involved in the growth of an industrial complex such as that of Lazaro Cardenas, and the lack of understanding of these phenomena, make it difficult to quantify a future demand for human resources in terms that amount to more than a merely academic exercise. The validity of the figures presented here is determind by that of the focuses and assumptions of growth processes incorporated into equations, which have the appearance of objectivity, but of necessity presuppose elements of a subjective nature. The fact that the task is difficult of course in no way justifies abandoning the aim of introducing some degree of rationality into the establishing of goals and objectives. Planning, after all, is only an ordered way of achieving fixed goals. The objectives of industrial growth set forth in the investment programmes appear to be based on expert assessments of sufficiently serious nature to involve much more complex achievements than the mere copying of the manufacturing models of other countries. In making the calculations, care has been taken to introduce types of technology, employment profiles, elasticity in demand, etc.

The qualitative aspects of this type of exercise comport ignorance and error in the equations, but even more important are the actual forms in which the human resources are incorporated into production, generating goods and services of a certain volume and quality. It is justly said that two of the most important components in productivity are the type of technology used and the management of its dynamics.

From the perspective of the educational and training systems, the problems of technological suitability acquires greater relevance not quantitatively but qualitatively. An

Table 67 - Administration and operation of the industrial port - accumulated demand for human resources, at constant productivity, Lazaro Cardenas

Occupational groups	1982		1985		1990		2000	
	L (1)	H (2)	L	H	L	H	L	H
Professionals	60	70	85	100	135	155	195	235
- Sciences and engineering	20	25	30	35	50	55	70	85
- Administration and accounting	30	35	40	50	70	80	100	120
- Others	10	10	15	15	15	20	25	30
Mid-level technicians	200	230	280	330	450	520	655	785
- Technicians	120	140	165	200	270	310	390	470
- Administration assistants	80	90	115	130	180	210	265	315
Qualified personnel	580	680	840	970	1 340	1 540	1 940	2 320
- Skilled workers	440	520	640	740	1 020	1 175	1 480	1 770
- Office clerks	140	160	200	230	320	365	460	550
Unskilled workers	80	90	105	130	175	205	250	310
Total	920	1 070	1 310	1 530	2 100	2 420	3 040	3 650

(1) Low Hypothesis

(2) High Hypothesis

attempt is made to foresee what specialists will have to be turned out, given certain production expectations, not merely with the label of 'engineer' and a supplementary adjective like 'chemical' or 'metallurgical', but what kind of 'chemical engineer', and how teaching and training systems will be tied in with the functions of productivity and the specific modes by which production in specific factories takes place. The same is true of technicians. It is not enough to discern that the proportion of technicians to professionals is greater or less; it is necessary to see what kind of technicians and what kind of professionals are generated by the system, why they are generated as they are, and how the companies use highly-trained manpower. It is undoubtedly at the level of skilled workers and administrative employees that the stickiest training problems will arise, for the simple reason of their greater volume.

In the Summary and Conclusions, we will analyze some of these problems, suggesting some aspects that merit study in greater depth and detail.

With respect to the demand for human resources, it is evident that the explosive velocity of growth - although somewhat decelerated in and after 1983 - will continue. Crisis or not, the public investment cannot be reduced to paralytic levels because the investment already made is too vast to be wasted. Increments in accumulated demand, calculated to grow at an average annual rate of around 22.9%, are of course reduced, although the above-mentioned authorizations for the second stage of Sidermex will make up for some of the reduction in demand for construction workers, since it is the principal employer. In the short run, the greatest part of the employment being generated is in the construction industry, where the greatest volume of demand is concentrated on personnel with a low level of qualification. Until 1985 or so, the technological changes that would be observed in the region will be relatively small; at that time increments in productivity will come to depend on the effectiveness of the training systems and on better use of the factors of production. The demand for human resources in 1984 varies as activities begin in an important group of companies - NKS, PMT, Fertimex and CONASUPO - which together with the industrial port will give rise to significant qualitative changes in an occupational structure as yet mostly composed of unskilled labour.

As we have seen, these companies as a group will in the short-term demand between 700 and 800 professionals, between 800 and 900 mid-level technicians, and between 8,000 and 8,500 skilled workers and employees. The demand for unskilled workers will be relatively small, between 900 and 1,000. These changes in the occupational structure will to some extent be reinforced in the second half of the decade, although at much less intense growth rates (3.1% annually at constant levels of productivity). Owing to the fact that construction will noticeably diminish during this period, its weight in the total employment will decrease to about one-third towards the end of the decade. An immediate impact will be a decrease in the relative proportion of unskilled workers, which will go down from 40% to 25%, while that of skilled workers will increase from 46% to 61%.

The problem of unemployed unskilled workers will oblige the authorities to assume special strategies, either of personnel training to facilitate their incorporation into a labour market that will have a strong demand for skilled workers, and/or the strengthening of migratory patterns that facilitate the entrance of personnel with the required qualifications into the micro-region. For 1990, the estimated demand by occupational category, under the low hypothesis, predicts a need for 4,250 professionals, 3,500 mid-level technicians, 37,000 skilled workers and employees, and 17,000 unskilled labourers. The estimates of professionals and technicians counted only those required by the industrial apparatus, that is, basically engineers and administrators. The calculations do not even consider the necessities for resources in areas not directly related to industrial production. For a city of the size that Lazaro Cardenas is expected to be by 1990, the need for professionals and technicians in the spheres of transportation, finance, health, and education could reach if not exceed these figures.

Finally, in the long term (by the year 2000), assuming that the activities of the industrial port will be consolidated, demand will come to depend on the growth of the large industries, as well as on the emergence and expansion of manufacturing activities, most of which are of the assembly type. Increases in the generation of employment in the calculations now depend on the scenarios of productivity, which at constant levels would represent a total demand for around 80,000 persons - at variable levels, some 60,000 persons. As can be observed in the calculations, scenarios at variable productivity presume capital-intensive technologies which make the demand for better-qualified personnel more intense. Growth expectations for the micro-region still predict considerable volumes in employment demand (around one-third of the total) in the construction industry.

Earlier, we noted that the type of professional personnel required for the industrial park is precisely that for which a deficit is predicted in the 1990s. If the deficit occurs, it will oblige the companies involved either to elevate salaries in order to attract these professionals, or to employ mid-level technicians in the roles of professionals. A polar situation may develop as concerns the overall outlook, first because of the deficit and its repercussions, and second (but perhaps more important) because of the great volume of jobs to be generated in the region for skilled workers. Thus many of the graduates from the technological schools, both in the region and nearby, will in fact be employed as skilled workers. What is a technician and what is a skilled worker? Clearly the distinction will be defined both by the jobs themselves and by the instruction and socialization received in the schools. Tables 68 to 72 summarize the accumulated demand for human resources by occupational groups for 1982, 1985, 1990 and 2000. Figures A and B in the Appendix to Chapter 7 show the percentage of each group in the occupational structure for these years.

Table 68: Summary: Accumulated demand for human resources, at constant productivity, Lazaro Cardenas, Mich.

Occupational groups	1982		1985		1990		2000	
	B[1]	A[2]	B	A	B	A	B	A
Total	29 855	33 140	55 250	61 805	61 820	74 360	132 280	166 215
Professional	1 555	1 760	4 000	4 435	4 250	5 070	8 870	11 090
-Sciences and engineering	835	940	2 010	2 215	2 130	2 520	4 420	5 470
-Administration and accounting	660	740	1 880	2 080	1 895	2 245	3 930	4 880
-Others	60	80	110	140	225	305	520	740
Mid-level technicians	1 230	1 440	2 710	3 150	3 500	4 360	7 460	9 865
-Technicians	870	970	2 050	2 300	2 100	2 515	4 315	5 465
-Administration assistants	360	470	660	850	1 400	1 845	3 145	4 400
Qualified personnel	14 270	16 440	24 940	29 220	36 970	46 330	80 950	106 960
-Skilled workers	13 270	15 240	23 140	26 920	33 130	41 290	72 290	94 910
-Office clerks	1 000	1 200	1 800	2 300	3 840	5 040	8 660	12 050
Unskilled workers	12 800	13 500	23 600	25 000	17 100	18 600	35 000	38 300

(1) Low hypothesis
(2) Middle hypothesis

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Table 69: Summary:*/

Accumulated demand for university graduates, at constant productivity, Lazaro Cardenas, Mich.

Occupations	1982			1985		
	B^1	M^2	A^3	B	M	A
Total	1 555	1 655	1 760	4 000	4 220	4 435
Sciences and engineering	835	885	940	2 010	2 110	2 215
Civil Eng.	335	345	360	670	690	710
Electricians Eng.	120	130	140	350	370	390
Mechanics Eng.	185	200	210	495	525	550
Industrials Eng.	60	70	75	140	155	170
Chemical Eng.	40	40	45	50	50	60
Agronomical Eng.	--	--	--	5	5	5
Naval Eng.	5	10	10	10	10	15
Metallurgical Eng.	10	10	10	40	40	40
Others	80	80	90	250	265	275
Administration and accounting	660	700	740	1 880	1 980	2 080
Lic. in administration	480	500	520	1 470	1 530	1 580
Accountants	180	200	220	410	450	500
Others	60	70	80	110	130	140

*/ Absolute Numbers
(1) Low hypothesis
(2) Middle hypothesis
(3) High hypothesis

Table 70: Summary:*/

Accumulated demand for middle-level technicians, at constant productivity, Lazaro Cardenas, Mich.

Occupations	1982			1985		
	B[1]	M[2]	A[3]	B	M	A
Total	1 230	1 310	1 440	2 710	2 940	3 150
Technicians in:	870	900	970	2 050	2 190	2 300
Civil Eng.	250	250	260	590	610	630
Topography	50	50	50	140	150	150
Mechanics Eng.	170	180	200	510	550	570
Electricity	130	140	150	410	430	460
Metallurgy	10	10	10	30	30	40
Industrial Chemistry	--	--	--	10	10	10
Fertilizers production	30	30	30	30	30	30
Food industry	--	--	--	10	10	10
Navals	10	20	20	20	20	20
Admin. and Operac. Port	60	60	60	80	80	90
Customs	50	50	60	70	80	80
Commerc. Intgernational	10	10	10	10	10	10
Draftman	40	40	50	40	60	70
Others	60	60	70	100	120	130
Administration assistant	360	410	470	660	750	850
Accounting Assistant	80	90	100	160	180	200
Administration Assistant	280	320	370	500	570	650

*/ Absolute Numbers
(1) Low Hypothesis
(2) Middle Hypothesis
(3) High Hypothesis

Table 71: Summary:*/

Accumulated demand for qualified personnel, at constant productivity, Lazaro Cardenas, Mich.

Occupations	1982			1985		
	B(1)	M(2)	A(3)	B	M	A
Total	14 270	15 340	16 440	24 940	27 010	29 220
Skilled workers	13 270	14 240	15 240	23 140	25 010	26 920
Construction workers	7 280	7 520	7 760	10 160	10 520	10 880
Mechanics and electricians	1 030	1 210	1 380	2 240	2 2530	2 830
Transportation vehicles workers	670	730	790	1 890	2 0.0	2 130
Operators construction equipment	180	180	190	610	620	640
Metallurgy workers	--	---	---	2 040	2 100	2 150
Metal manufacturing workers	1 860	2 010	2 160	2 640	3 080	3 510
Fertilizers production workers	370	380	390	370	380	390
Food industry workers	---	---	---	260	280	300
Winch and crane operators	80	80	90	110	120	130
Longshoremen and similar	200	220	240	290	310	340
Seaman	30	30	40	40	50	50
Others	1 570	1 880	2 200	2 490	3 010	3 570
Office clerks	1 000	1 100	1 200	1 800	2 000	2 300

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*/ Absolute Numbers

(1) Low Hypothesis

(2) Midile Hypothesis

(3) High Hypothesis

Table 72 - Accumulated demand for human resources and annual rates of growth at constant productivity, Lazaro Cardenas (figures represent a mean between optimistic and pessimistic estimates)

Occupational Group	Period			
	1982-1985	1985-1990	1990-2000	1982-2000
Professionals	36.4%	2.05%	7.9%	10.4%
Mid-level technicians	30.2%	6.1%	8.2%	11.03%
Skilled personnel	20.8%	9.0%	8.4%	10.6%
Unskilled workers	22.0%	6.0%	7.5%	5.7%
Total	22.9%	3.1%	8.1%	9.0%

1. The dominant themes of development

We have considered the question of the contribution of educational systems and job-training programmes to industrialization and technical progress in a specific region, first by placing the problem of general relations between education and development in the historical context of Latin American thought, and then by describing the characteristics of the zone to find concrete and specific answers.

Such a focus is justified by the fact that the answers and alternatives for action elaborated in other contexts have had unsatisfactory results. Disagreements among specialists about the fundamental assumptions and the most appropriate strategies are abundant; there is not even clear agreement concerning the minimum bases on which congruent policies and relevant programmes of action can be defined and appropriately implemented.

Mexico is a country in which planning has reached important levels of promotion, but also where programmes without appropriate planning abound. It is a country where an important level of participation and consultation has been reached - particularly within the intellectual, academic and political community - especially between six-yearly changes in government, during which the problems, the possible alternatives and the methods most appropriate to correct the anomalies are reconsidered. General proposals and solutions to the problems are defined in government plans and reform proposals whose progressive nature is internationally recognized. Concrete programmes and mechanisms for achieving goals, however, are developed by technical offices and restricted by particular relations and determinations of priorities between the various levels of power. There is a chasm between policy and action in all aspects of government organization that causes a general problem of communication and a lack of efficiency in the implementation of reforms; more important, it impedes the breaking away from old patterns of unequal distribution of wealth, promotes a subsistence economy in rural areas, fails to stimulate an urban economy incapable of absorbing an ever-growing population, and promotes educational growth based on consumer patterns with little power to achieve social equity or improve educational quality.

Latin-American thought concerning progress, industrialization and development has been influenced from the start by North American and European thought. In this sense, Latin-American thought is "occidental". In the early stages of decolonization, the great concerns and programmes of government were based on the ideals of progressive revolutions that had taken place in Europe and the United States. With regard to education, the main concern was the formation of responsible citizens for the new nations, citizens who would assume the task of imposing 'civilization' on its opposite - 'barbarism'. The reflections of Alberdi, Sarmiento, Bolivar, Varela, Juarez and others on the value of education in the secularization process, and their 'growth models', were opposed by more conservative elements; these oppositions still exist. Alberdi's dilemmas regarding the possibility of industrialization and diversification of the economy versus the need to concentrate on the primary section are valid problems today, as can be seen in CEPAL's recommendations of industrialization in the peripheral countries.

One hundred and seventy years after the beginning of decolonization, the central topic of the continual controversies (now with more technical and sophisticated arguments) is still that of dependence and independence, and the means of achieving what is now called self-reliance. And a good deal is expected of the educational system in elevating citizens and communities to new horizons. Although challenged by some, goals set by Simon Bolivar, in one of the first decrees of the newly-literated nation of Bolivia, continue even now to be imperative:

> "...first. it is the first duty of government to provide education to the people; second, this education should be uniform and general; third, educational institutions should be in conformity with the laws of the State, and fourth the health of the Republic depends on the moral values that the citizen acquires in childhood through education."(1)

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(1) Decree signed by Simon Bolivar in Chuquicamata, December 11, 1825, which also designated S. Rodriguez as Director-General of Education in Bolivia. The decree

Education, industrialization and technical progress in Mexico

Whereas the dominant themes of progressive groups in the 19th century were those of the secularization of societies and of the moral formation of responsible citizens (with a conception of the world that gave to reason the status of 'principle orderer' of the universe), the topics that came to dominate the arguments of such groups inm the 20th century were a questioning of the optimistic assumption that progress is achieved by reason and an emphasis on the relations of power and domination between nations and among social classes. Meanwhile, in other spheres, particularly planning, substantive rationality gave way to instrumental rationality, and the topic of economic planning and the co-ordination of inter-institutional activities acquired prominence.

At different rhythms, the Latin-American countries would begin to experience important transformations in their economic, political and social structures, accompanied by an extraordinary expansion of their educational systems. But the transformations occur in structures that systematically generate crises and establish limits and qualities. And the causes of the crises are systematically and irremediably related to the dynamics of the development of capitalism on the world level, and to its particular type of structure as a generator of limitations to the development of self-reliance in the periphery.

The extraordinary expansion of the educational systems satisfied few, and important problems were detected regarding their internal and external efficiency particularly, in recent times, the difficulty of financing a system in constant growth.

Until the middle of the century, the dominant themes in education were pedagogical and political, the latter mainly focused on higher education and its role and function in society. Since 1918 throughout Latin America a series of social movements were undertaken that culminated in part in university autonomy, allowing the state universities to become an independent political community - a kind of political conscience of the state - one of its main roles being to denounce corruption and irregularities on a national scale. Its influence in the modelling of society became more pronounced, entering into direct confrontation with the most powerful interest groups in society: state, church, armed

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(1)(contd.)
specifies the organization of the education system; for example, criteria are established for the installation of primary schools in each town of 200 or more, secondary schools in county capitals, arts and science colleges in the provincial capitals, etc.

forces, agrarian oligarchies, industrial bourgeoisie, and even sometimes organized labour. What is of interest to this project is that part of the price to be paid for autonomy was isolation from the activities of production. With a structure similar to those of the European universities, the dominant ideas in the Latin-American universities were French (the university as a body at the service not of men but of universal knowledge). Universities were mainly public (Napoleonic concept, but considered to be politically autonomous; the dominating concern is more theoretical than pragmatic (a British characteristic), but with an idealistic image of science and a search for the universality of knowledge (a German characteristic), all this in turn permeated by the ideals of socialism and Marxism. To further complicate the issue, lately there has been pressure to give the university a more pragmatic nature (a North-American characteristic).

With regard to the general educational system, two tendencies have developed since the 1950s and appear to be predominant on two distinct institutional levels: a) in academia, the emphasis is on the critical aspects; denouncement-diagnosis and identification-diagnosis of the educational system are over-riding; b) in public planning agencies, criteria of a more pragmatic than theoretical nature are applied by means of models, schemes and diagnosis of an economistic type. The separation between the two tendencies is reinforced by focusing the former on the problems of the social division of labour, and the latter on the technical division of labour.

The educational system expanded, generally imitating the consumer patterns of the metropolis, and was for a time subservient to the power structures that reproduce through education the upward-mobility expectations of the new groups that are generated in society. But such a role gives rise to problems as soon as the productive apparatus is incapable of absorbing the graduates that the system proliferates.

Expansion was encouraged by theories that insisted on the necessity of investing in education, on the assumption that this would result in increments in the levels of rationality, in the individual and collective innovative capacity, increased productivity, in the ability to generate income, etc. All of these assumptions were severely criticised on the theoretical, epistemological and methodological levels.

2. Working hypotheses and assumptions

The project was based on a set of fundamental working assumptions and hypotheses, of which the following are the most important:

Education, industrialization and technical progress in Mexico

1. Solutions are not to be found in the extremes of (a) conceiving of the problem as a *technical* one, with already-established solutions, ready to be applied as soon as society is organized in such a way as to accommodate itself to the changes, (b) expecting that *nothing can be done* until the contradictions reach the point where the processes change by themselves, (c) having the *will and good intentions* to make improvements not based on any real possibilities or conditions.
2. It is necessary to search for a reasonable balance between the *economic* necessities of producing, the *ethical* ones of a fair distribution, and the *aesthetic* ones to take into account the quality of life. In short, a society is sought in which the problems of subsistence are not reduced merely to food, but include transcendental questions, ideals, and aesthetic pleasures.
3. Education is a continuous process throughout life, and the formal educational system is only part, albeit an important one, of this process.
4. Evolution, progress and development are determined not by purely subjective nor by purely objective factors, but operate on both the objective level of concrete institutions and social sciences, and on the subjective level of values, attitudes and motivations. There is a dialectic of the relations between the objective and the subjective, a dialectic that connects man and his creations. Civilization is not a natural product that emanates from the nature of man, nor is it an entity foreign to man. Man is formed in the measure of his civilization, and civilization is formed in the measure of man. "The future", says Suchodolski, "is not just a reality that is awaited passively, it is a reality that has to be forged". Planning is important, but in order to plan, it is necessary to have an idea of man, of his relations with nature, with other men, with civilization and with technology. Science and technology, the maximum expression of present knowledge, are a double-edged sword, representing a potential for well-being and progress as well as an instrument for alienation, domination, and even extermination.
5. The promotion and co-ordination of the educational, scientific and technical activities of a society depend on a series of highly complex factors, among which professional training, proper utilization of resources, the formulation and implementation of coherent plans, indeed, the whole utilization of technology for achieving development goals, are not *the* elements that will release the 'chain reaction' that will in the long run produce growth, social justice, and democracy. Obstacles to change and progress are found not only at the level of job motivation and attitudes and the availability of sufficiently qualified manpower. Important as these are, the

problems of generating change, and even the possibility of doing so, has to do with structural factors related mostly to power and conflict relations between groups and social classes, to the type of social force promoting change and its objective, to the histrocial conjuncture, to the degree of external dependency, to the dominant modes of production and the type of capital accumulation, to the availability of financial resources, etc.

6. The intellect is perfectible. Variations in the systems of communication, in the methods of socialization, etc., that result from the physical, social and cultural environment of different social classes tend to have different effects on the processes of thinking, the structuring of experiences, and in general on the development of the potential of the individual. The social-class system of society determines and frames the distribution of knowledge and the potential answers that tend to be produced within sub-cultural identities. Children enter school with such differentials, and in general the school system tends to reinforce them. However, there is in the school as an institution an important potential for the resolution of these problems, once knowledge and suitable teaching methods, together with the personal commitment of the actors involved, are effectively applied.

7. Schooling is relevant and its main function is to allow man to adjust to and to change his general environment. Basic education is a fundamental right, a political conquest and a fundamental tool in the construction of a democratic society; it is not a consumer good. Its basic objectives are social and cultural democratization, and the development of learning abilities, basic abstract thought, creative imagination and capacity for action in all segments of the population. The cultural purpose of the school is to teach people to learn, to think, to analyze, to question.

8. Development in learning theory in recent times has been considerable, and the possibility of its application by qualified personnel opens up a world of alternatives. Learning is a term utilized provisionally to denote the acquisition of sets and subsets of skills, of ways of thinking and doing things, of values, beliefs, and knowledge. It is not possible to learn "facts" or things in a vacuum; one learns standards, aspects of what is being learned, goals to be reached. Standards and sub-standards are changeable, and the process of knowledge and learning moves from a simple level related to the visual, concrete and immediate demonstration, to more complex, more specialized, more abstract levels. To the degree in which it is impossible to separate learning from objects of learning it is impossible to make someone learn something as a unilateral act; in order to learn, one has to visualize the

standards and see how can they be achieved. The pedagogical problem is then one of control of the conditions of learning, that is, the combination of individual motivation and disposition with aspects related to the presentation and development of the standards.

9. The 'minimum' or 'basic' levels of education, and the role that education will play in society as a whole in various groups and social classes, are determined on the basis of the available resources, the values, and the future projects for the society of the groups in power. But in the final analysis the so-called 'educational problem' is always a political and cultural one, where options and values are put into play that any society must confront: national integration, fundamental rights, level of participation, cultural heterogeneity, distribution of knowledge, etc.

10. The sophist ideal of the formation of conscious citizens, judicious and eloquent, who base their actions on science, on logical thought, on the culture of the spirit, and on language, continues to be value. In the same way, there are valid principles of forming a broad and open intellectual class, and a culture based on self-observation, self-awareness and criticism.

11. Education is one of the important elements in the formation and training of the labour force and one of the factors of productivity. Important, however, does not mean determinant. The factors that determine growth and development are established on other levels.

12. The quantity and quality of the education of the population established limits to the possibility of selecting strategies of industrialization and development. When the level of education of the working force is low, the possibility of development of sectors directed toward the production of machinery and equipment, chemistry and electronics, the naval industry, etc., is limited to assembly procedures. Poor educational profiles in the labour force and low levels of qualification result in low quality of products, low potential for participation and innovation, increased dependence on imported technology, and hinders the establishment of companies oriented toward the search for original products and new forms of production by adaptive innovation based on existing products and processes.

13. The relationships between education and employment and education and training systems depend on socio-economic factors and on the different ways in which labour and production are organized within the companies. At the same time, the labour market has increasingly flexible and changing characteristics. With the possible exception of occupational categories of high degree of professionalism, the educational profiles of the

different occupational categories will tend toward heterogeneity. As a consequence of all this, there is no point-by-point correspondence between years of study, type of specialization and occupation.

14. Professional qualifications are acquired in concrete job situations. A detailed description of the set of capacities associated with a given occupation can be given only within a specific company, because such capacities depend not only on abstract definitions but on the particular technological and organizational conditions of the company.

15. Relations between development and technology are close and direct. The sources of technological change are many and although tendencies are towards making the generation of technology a specific organized activity with its own identity and legitimacy (by means of "factories" of technology), and although the development of technology in the future will depend more and more on organized pure research, at present the acceptance of technology as a sub-product of science hides a process which is in itself complicated.

16. The utilization of appropriate technologies is a key factor in the process of development. The implementation of programmes to overcome the problems of technological dependency through the broadening of the size and quality of the system of science and technology, including the improvement of the educational system at all levels, should be directed toward a more harmonious functioning of the productive structure and the scientific-technological infrastructure.

3. Plans for the Conurbation

With the support of an infrastructure developed during the sixties (the hydroelectrical dams at La Villita and El Infiernillo, and roads connecting the region with the Federal District via Acapulco and Morelia), followed by vast investments poured in by the federal government during the seventies, especially in the County of Lazaro Cardenas (a steel mill, a fertilizer factory, the construction of a commercial and industrial port, the development of irrigation systems) and in Ixtapa-Zihuatanejo (an international airport, hotels, fish canneries), important transformations in the productive structure of the Lower Balsas region have made an almost stagnant region highly dynamic.

As a strategy for development, the creation of poles in regions of high potential (industrial and tourist centres in this case), had as its major objective the search for a combination of the impacts produced by diversification and increase in the factors contributing to production, along with improvements in the distribution, integration and standards of living of the regional population. An economic strategy based on state control of industries, such as electricity, steel, oil and mining, and the substitution of imports was expected to correct the structural defects produced by the previous economic model. However, the strategy of the poles was capital-intensive accumulation, industrial complexes, and a structure oriented towards national and international markets, with minimal benefits for the local markets. The poles, in this case, are nothing but economic enclaves.

The expected changes in the Conurbation were accelerated only at the "poles"; changes in the interior, however, were specific and unexpected.

The new dynamics in the Lazaro Cardenas and Ixtapa-Zihuatanejo centres resulted in a series of changes that may be qualified as both positive and negative, positive in the diversification in the structure of production, increase in productivity, generation of new employment, greater and better services, generation of goods for the national and international markets, increase in the average income of the population, better perspectives for the future in an area that until then had been isolated from the rest of the country, and had produced only copra. The negative consequences had to do with inadequate conditions in housing, bad sanitary conditions, increase in labour accidents, constant threats of unemployment and underemployment, inflation, consumerism, concentration of income, social tensions, pollution, degradation of the environment. In the hinterlands, the positive consequences are less noticeable and the negative ones magnified, especially in hamlets that are distant from the dynamic centres.

In the agrarian sector, there is the overwhelming dominance of a traditional rural economy. In the entire Conurbation, there are 11,000 agricultural production units, 8,817 of which are included in the ejido system. Agriculture produces at very low levels, using primitive criteria to decide the use of the soil. Exchange and "entrepreneurial" relations are rare, and minifundia or smallholding systems, of which the ejido is one, are exploited - in a general context of poverty and want. There are indications of concentration of land and of the scarce economic surplus in the hands of a few, especially in the trade circuits.

Approximately 70 per cent of the plots use traditional agricultural methods and tools - most of them in the mountains. Land is worked basically for one's own consumption, expansion into new land is usually by means of swidden agriculture - a precarious, primitive and unstable system contributing to ecological degradation and aggravating the problems it attempts to solve. The remaining 30 per cent of the agrarian operations are in the coastal regions and the irrigation district near Lazaro Cardenas.

Agriculture is already in the process of modernization, of production techniques as well as of the type of goods being produced. The problem here is the competition of the urban sector for the scarce fertile land, and the orchards that are beginning to predominate, and which are intended for the same consumers as the industrial goods - the national and international markets.

This is the regional plan, designed to produce regional development and to reduce dependence on international markets that produce economic, technological, scientific, cultural and political dependence.

In a growing region, what is the contribution of education and training systems to industrialization and technical progress? What is the present situation and what are the perspectives in the medium and long term? How can what we know on a global level be utilized to solve local problems? How can 'explosive' industrial development be compatible with changes and development in the agricultural sector?

Placing the problem on the regional level, one of the first things to be taken into account is that we are dealing with a region of explosive growth in which the dilemma of choosing between labour-intensive or capital-intensive activities is not presented in a direct and dramatic form to the urban-industrial sector. The industrial production complex of the type now established and being established in the Zone requires specific qualified human resources; once the companies are identified, their estimated volume of production and the type of technology to be applied, it is possible to calculate the key human resource needs in more or less precise numbers. It will also be less complicated and very useful to determine the future supply and demand of professionals, technicians, skilled workers - again in numeric terms - from the estimations of growth and changes in the population structure.

However, the calculation becomes complicated as dynamic variables are introduced. If the strategy is one of development, is the industrial production of steel, fertilizers, boilers, etc. of itself a necessary and sifficient condition? Or do steps have to be taken to confront the aspects of technological innovation and technical progress being generated within the industrial complex? Can the strategies at present being used effectively lead to the creation of dynamics distinct from those which reinforce the chains of dependency?

The agrarian structure, on the other hand, is poor. The agricultural sector, considered until now only marginally in the planning of the region, is submitted to the logic of industrial and urban growth. The diffusion of technical progress is limited and slow, and subsistence-level economic activities are, and will probably continue to be, predominant. Technological backwardness is generalized. The areas with the best agricultural potential are those near the development centres: the short-term tendency is towards the expansion of permanent types of cultivation (such as fruit trees), but in the long run competition with the urban sector for land will make even these crops disappear.

The rural spaces consist principally of two sub-regions: the coast and the mountains. In the latter, corn, peanuts, sesame, and bean production continues as the basis of a precarious traditional system. Increasing population and over-exploitation of the land, the use of primitive technologies that are transmitted from generation to generation without adapting to changing needs and conditions, are phenomena that feed upon themselves, causing a growing degradation of the natural conditions and a decline in the arable land. The great majority of the ejidos located in the mountains are isolated and marginalized, with little or no internal organization. The problems of middlemen in the sale of farm products, the inflexibility of credit, irregularities in land ownership and occupancy, are all problems endemic to the region, and have little chance of being overcome.

Population growth in the region has been phenomenal and is estimated to continue in the future. In 1930 there were 30,871 inhabitants in the whole Conurbation; in 1950 the population of the county of Lazaro Cardenas alone was 5,000. A region characterized by its slow growth and its emigrating population has since the sixties rejected the impact of investment. By 1980 about 190,000 persons inhabited the Conurbation, the majority of them in Lazaro Cardenas and in Zihuatanejo. The most optimistic projections for the year 2000 estimate that 1,671,000 people will inhabit the Conurbation, (94 per cent in the Lazaro Cardenas micro-region); a less optimistic estimate is 680,000. The degree of urbanization expected for those years would be 95 per cent of the population living in localities of more than 5000 people.

Until 1970 the educational level of the population was extremely low. Almost half the population was illiterate, rates of primary schooling very low, the number of persons with post-primary education insignificant - 1,649 persons in the entire Conurbation). Since 1970 educational supply has expanded materially, especially in the poles. In rural areas, it has begun to be more widespread, although schools are often incomplete - less than six years, and with only one teacher. On the post-primary level, supply has intensified, especially in Lazaro Cardenas and Zihuatanejo, but also to a lesser degree in other localities with some degree of urbanization. There is no supply of higher education.

There are serious problems of internal and external efficiency, and especially of quality in the education provided. In the rural areas quality is poor and conditions very difficult. All the secondary schools, half of which are technical schools, are located in urban areas. On the upper-middle level, most of the schools are of the terminal type.

The job-training systems are entrusted either to the individual companies or to government agencies such as the Instituto Mexicano del Seguro Social, and CONALEP. Highly-skilled personnel are generally trained outside the region, either abroad (in companies related to the industrial activities of the Zone) or in national enterprises.

Finally, taking into consideration estimates of industrial growth, the magnitude of the works, future investment, types of technology, population volume, and some characteristics of the structure of employment, forecasts have been made of demand for key human resources in the industrial sectors and in some service areas in the Conurbation and for the Lazaro Candenas microregion. It is estimated that the demand for personnel with middle and higher levels of qualifications will be concentrated mainly in the secondary and terciary sectors of the economy. Demand in the primary sector, especially in agriculture, will be reduced.

Compared to the calculations done by other organizations for the whole country and for the Conurbation, we have found that shortages of professionals in certain key areas nationwide - civil engineers, communications engineers, public works engineers, chemical engineers, electro-mechanical engineers, medical doctors, high-school and university professors, accountants, economists - will also be felt in the Zone. A detailed list of the calculated (optimistic and the pessimistic) human resource needs, broken down into engineers and administrative professionals, mid-level technicians and administrative assistants, skilled workers, and clerical workers, is presented for the years 1985, 1990, 1995 and 2000.

B. Conclusions

Decisions in the Conurbation do not concern whether there will or will not be changes, but rather the direction or impulse that they should take and the impetus that should be given to them. Starting from the assumption and the evidence for the fact that allowing the spontaneous emergence of urban enclaves does not constitute a policy for self-sustained development, nor for regional integration, nor for promotion of autonomous technology, the organizations in charge of planning and those entrusted with the programmes of action are presented with three alternatives;

a) to go along with the present tendencies towards differentiation and inter-regional disintegration. The attempt would be made to correct some 'deformations', without searching for an alternative;

b) to formulate plans and programmes that maintain the levels of differentiation at present values, that is, prevent their widening. This alternative cannot be summarily dismissed, because many may offer the opportunity to study in greater detail the real potential of a strong agricultural development;

c) to formulate plans and programmes for the middle and long term that accept the challenges of transforming the regional plan in a relatively unified manner to minimize the inter-regional differences and organize the productive activities, to promote the educational preparation of the young generations and the participation of the community in the goals of progressive integration, to diversify production, to increase productivity, and to improve the standard of living - all this within the framework and limitations imposed by the overwhelming presence of industrial activities of the proposed magnitude.

The possibilities of implementing the third alternative depend to a great extent on a radical change in attitudes towards development and growth.

On a national scale, the relationships of formal education with job-training systems, strategies of industrialization, development and technical progress are conditioned by the system of production and by the objective conditions of the national and international economic environment.

The era of rapid growth typical of the post-war period has given way to a profound crisis, and the models of expansion based on the exporting of industrial manufactured goods must be adjusted and corrected in function with the new characteristics and conditions of the market. In the short term the outlook for the international market seems sombre in both commerce and finance, and growth in the Zone is undoubtedly influenced by these conditions.

Many of Mexico's characteristics are favourable to industrialization:

- the abundance of natural resources, especially minerals and petroleum;

- geographical proximity to large markets, especially the U.S.A.;
- a volume of population sufficient to create an internal market;
- relatively cheap labour;
- a strong national government which constitutes a dynamic agent for growth;
- an atmosphere of participation and democracy along with solid political stability;
- a growing educational system with possibilities for improving its quality.

Mexico has the following problems to overcome to facilitate the processes of industrialization and development:

- high concentration of income;
- a lack of dynamism in the private sector;
- an agricultural sector that is little integrated into the industrial sector and divided - one type very efficient and oriented towards export crops, the other (the majority) at subsistence level and inefficient;
- high population growth rate (2.4 per cent) (but this is already decreasing);
- pronounced regional inequalities;
- bureaucratic corruption and inefficiency;
- gaps between the general plans formulated and their implementation;
- lack of continuity in the strategies of change.

The policies of regionalization and the Law on Urban Settlements included in the national overall programme for development constitute important steps toward the resolution of problems of population agglomeration, diseconomies of scale, low competition and productivity levels in industrial activity, etc. A National Plan for Urban Development defines priority zones and formulates policies to encourage growth in a few key regions, in which agencies for development planning have undertaken feasibility and technical studies. The present financial crisis, however, may stimulate policy changes that will put at risk all of the advances and investments made so far. The objects of capital and infrastructural investments in the Industrial Port of Lazaro Cardenas have for the most part already been completed, and it would be most desirable not to starve them. The positive aspect of the present crisis is the opportunity it provides to redirect the focus of regional development on more clearly defined and higher priority goals. Special attention will have to be directed toward arable land, particularly where soil conditions are favourable. Respect for the local population and the evaluation of conditions such that growth will be favourable to it should be basic to all decisions and actions.

The elimination of industrial wastes could become a problem in the near future. Particularly serious seems to be the case of Fertimex, which will be depositing large volumes of chemical wastes into the coastal waters, and eventually the whole tourist and fishing industries could be endangered. Similarly, Sidermex may be exuding industrial wastes already affecting the quality of soil and air, the health of the population, etc.

The city of Lazaro Cardenas does not have a very good climate, the population is constantly growing, and it has not benefited from enough urban planning to make it attractive. There is a sort of 'frontier city' atmosphere, in which people are isolated and community spirit is low. As a consequence, no doubt, the rate of personnel turnover in the companies is high. Measures must be taken to improve services, develop green areas, promote cultural activity, and ensure appropriate housing, and the same is true in all the urban localities near the industrial and tourist centres.

The agricultural sector, characterized by low levels of production and exchange, primitive technology, backward and damaging in soil-use practices, archaic social relations, etc. generates an environment of generalized poverty.

Progress is not diffused from the centres to the backward regions. An urban logic fosters adjustment to the reigning conditions (topological, edaphological, climatic, and speculative), following the lines of least resistance out of egotism, habit, attitudes and values that, together with the objective conditions, will relentlessly widen the distance conditions that favour integration and regional development.

At the end of Chapter 4, we suggested measures that might help to break the vicious circle that degrades the natural conditions, reduces the cultivable surface, increases soil erosion, and in general leads to low productivity. These suggestions refer to the use of the soil and of technology, cattle raising, the physical circulation of goods, the commercialization of input and output, and the systems of credit. We analyzed some of the factors that impede the growth of agriculture and diversification of production: a) the occupation of most of the fertile land for urban expansion or for coconut plantations whose maintenance is minimal and requires little manpower; b) the elevation of the cost of land because of its proximity to the industrial centre; illegal speculation with ejido land, 'ghost' plantations to raise the cost of expropriation, etc.; c) incapacity to compete with salaries offered in the urban sector; d) resistance to the use of irrigation systems by some farmers; e) restriction of water to increasing the productivity of present crops and reluctance to initiate new ones; f) concentration on export crops at the expense of those for local consumption; g) suspicion of modern technology, and extreme dependency on state agencies for its effective use.

In the agricultural sector, increases in production and productivity in the middle and long term will be achieved through increases in yields more than through incorporation of manpower.

The scarcity of water is a serious problem on both urban and rural levels. The provision of water for industrial uses is already ensured, but the problem of providing potable water in sufficient quantity and quality to urban, and especially to rural, areas remains to be solved. The water supply is closely related not only to increasing food production but also, and more important, to the health of the population. High infant mortality rates and poor nutrition are associated with low standards of hygiene and with the quantity and quality of water. The health of the population also depends on the proper disposal of excrement and garbage, and to personal hygiene and home cleaning habits. The school can play an important role in raising sanitary standards and cultivating proper eating and cleaning habits in children.

Mining in the region has been principally restricted to iron ore and some gold and silver. There is a variety of ferrous and non-ferrous minerals whose exploitation is irregular or nil, but which could be promoted once the feasibility studies are completed. The possibility of opening schools of mining technology in the area should be explored.

The contribution of education and training systems to the Conurbation is linked to the generalization of literacy throughout the population and on increasing the quantity and quality of primary schooling.

a) Generalization of literacy is essential to full-scale industrialization, to the optimization of agricultural productivity, and to cultural and social democratization. Reading and writing are the basis for acquiring other learning and skills. Efforts should be especially directed toward the rural areas, which now offer the fewest opportunities and require the most assistance. The importance of education in the long term is assessed in function with the quantity of transformations that must be made in which rural citizens should be active agents - in the use of irrigation systems and other farming techniques such as fertilizing, crop rotation and diversification, the organization of production, trade and land use, etc. In both rural and urban zones, literacy is a prerequisite to developing systems of training for participation and for the job. In the long run it will determine the costs of future training programmes, because the higher the literacy rate, the greater the possibility of implementing mass media and other non-formal, cheaper training tools.

b) It goes without saying that if illiteracy is endemic in the region, it is because of the low rate of primary-school enrolment and the high dropout rates. The guarantee of access to and continuation in a school system that is qualitatively acceptable is an urgent priority, and efforts should be intensified to eliminate the enormous gulfs between plans and programmes and their effective application. Particularly alarming is the situation -- especially in rural and marginalized urban sectors -- where schooling is very poorly funded, only 2 or 3 years long, and, without sufficient materials. Such schools create the illusion that the problem is being solved when in fact, in the medium and long run, the problems they are creating will be even more complicated and difficult to resolve. Urban and rural communities should be provided with complete primary schools, constructed with solid materials, with adequate sanitary facilities and adequate teaching materials, and above all, with qualified teachers. To serve the low concentrations of population in the mountain sub-regions, it is recommended that boarding and day schools be created in key localities. These schools could absorb a fairly large number of children in whose neighbourhoods schools do not exist or are incomplete. Economy of scale will make concentration in these subregional centres useful in offering not only educational services but others, such as health, as well.

c) Teachers should be better prepared not only in the normal schools that provide the teachers for the Zone (Normal de Chilpancingo and Normal de Arteaga) but also through continuing programmes. The opinions of the teachers of the region must be taken into account in formulating any programme of action or determining the types of courses to be offered, and their participation in making these plans is essential.

d) Schools, health centres, an other social services must be extended to the communities, promoting literacy campaigns amongst the farmers and other workers, along with family planning, nutrition and hygiene information, production improvement techniques, etc.

On the level of secondary education, efforts should be intensified in several directions:

a) To eradicate the rupture between the patterns of two sub-systems, one for the more privileged groups -- to meet university-entrance requirements and leading in general to non-manual occupations, the other, of the terminal type, for the preparation of the manual labour force. The terminal or non-terminal nature of a school is decided in part by the opportunity-costs of continuing education, and these in turn depend on the supply of jobs offered on the market and then on income levels. The enrolment balance among the different modalities of the educational system cannot be improved through strategies that assign a terminal status to schools of technology and science.

b) At present, basic education in Mexico is defined as nine years of schooling. Measures should be taken to see that, once the problem of elementary school has been properly solved, the universalization of the first three years of secondary school is guaranteed in the Conurbation. Every locality with more than 1500 inhabitants should have a lower-middle school.

c) Access to productive jobs and the possibilities for social and occupational mobility will be highly dependent on the level of education of an individual. Expansion of productive employment, increases in the technology of production and changes in its structure, will create a great demand for differentiation in the labour force, not only in the production of goods but in services. This is important in a strategy for diversifying the middle education system, but the system should not so much be oriented towards training for specific occupations as grounded in general modalities, with equivalent academic levels.

d) In the ideal model, the formal education system is a pyramidal structure in which knowledge, skills, learning and adaptations become increasingly complex and abstract as one goes higher. Curricula and programmes continue from knowledge acquired in previous stages. Each level of the system has its general and specific goals pedagogical, cultural, social, political, economic, etc. - and the system culminates in academic or professional cultures. The adjustments that graduates from any level must make for incorporation into higher levels of the system or into the job market depend not only on the level of specialization reached, but also on the degree of versatility, adaptation, and applicability of the leaning acquired to the resolution of problems and to the capacity for conducting themselves at more than one level of activity. Specific learning takes place in concrete situations. The speed, quality relevance, and the possibility itself of learning at a higher level depend on the effectiveness of the learning at the lower levels. One learns to learn, either to rise in the system or to specialize in a given task.

- each level and each course within a level should ensure that the goals defined as desirable are in fact achieved;
- job training depends for its effectiveness on the levels of learning of basic knowledge (basic being that which is

- required to be learned within each modality and level and major specialization);
- the effective learning of specific tasks in particular occupations can be achieved only through practical work experience within a company. This is valid for any occupation, and explains why companies prefer to hire experienced personnel.
- the greater the proportion of routine activity in a task, the less time will be needed for job training, and the lower the educational level required.
- the development of different modalities within an educational system permits some flexibility that differentiates general areas of knowledge, with relative degrees of specialization. On the secondary level, the differentiations between general bachillerato and technological schools in the areas of industry, commerce, the services and agriculture are acceptable on the condition that the instruction within each one be relatively homogeneous, and the specializations are directed toward the learning of cultures: humanistic in the general bachillerato, scientific in the technological programmes. A number of studies have been focused on the formulation of appropriate curricula to arrive at a balance between culture and science and technology; and between general and specific training.
- access to the cultures of the groups with highest status has been associated, as far as education goes, with the modalities of general education (the bachillerato). The vocational-type schools, for their part, have been directed toward job training for the lower-status groups. In industrialized societies this relationship tends, if not to disappear, at least to change, either by raising the educational thresholds or through the nature of institution itself where the studies take place. In such societies the technological-scientific type of education loses its vocational nature and is transformed into a modality in which a particular type of culture is learned. The ideology of the middle-level technological system in Mexico is strongly dominated by a vocationalist orientation, and by particular types of socialization and learning in labour and social subcultures that ritualize the reproduction of the class system in a system that emphasizes 'discipline', relations between 'bosses' and 'employees', etc. The system seems to be geared to producing supervisors and foremen. Technical knowledge and the acquisition of technological culture, are influenced by societal values that look down on technical education. Special efforts should be made here for better training of professors and

other academic staff, who are mainly responsible for this reproduction.

- Special care must be taken in expanding an occupational structure which, although it presents the greatest potential for change, permits its middle- and upper-level graduates in technological subjects little possibility of access to the system of production, as the present agricultural structure of Mexico is doing. The calculations of the SEP indicate an oversupply of 19,000 professionals in the area of cattle raising, some 5,000 in phyto technology, 2,400 in fishing, 2,900 agroparasitologists, and 1,000 fruit growers by 1990. The problem of mid-level technicians will be much more severe, as the number of graduates will be much greater.
- Although politically not recommendable in the short term, it is necessary to begin to investigate the possibility of at least partially covering the costs of education on the upper-middle and upper levels by tuition fees. With a system of scholarships and other types of financing, the needs of the lower-income groups could be covered. The present system of almost totally subsidizing higher studies at the cost of the quality and quantity of basic education is not satisfactory.

With respect to relationships between education and job training and the labour market in the Conurbation, the findings indicate that

- the demand will be concentrated in the secondary and tertiary sectors of the economy. Only the industrial port will generate many jobs: according to the most pessimistic hypotheses, the demand will grow from 30,000 jobs in 1982 to 132,000 in the year 2,000; in the optimistic estimates, the demand will grow to 166,000 jobs.
- short-term demand (1982-1985) will grow most rapidly in the professional group (36.4 per cent annually), followed closely by the demand for mid-level technicians (30.2 per cent). Between 1982 and 2000, overall demand will increase by 9.0 per cent annually. By occupational group, the demand for mid-level technicians will be the highest (11.03 per cent) and that for skilled workers 10.6 per cent, for university graduates, 10.4 per cent, and for unskilled labourers, 5.7 per cent. It is calculated that for the year 2000, the structure of the labour force employed in the industrial sector will be 60 per cent skilled workers and clerical employees, 27 per cent unskilled labour, 7 per cent university graduates, and 6 per cent technicians. An idea of the enormous educational effort to be made to evolve a strong industrial sector is indicated by the fact that in 1970, 38.6 per cent of the economically-active

population employed in industry was either illiterate or had between 1 and 3 years of school, and another 44 per cent - 21 per cent had 4 to 6 years of school.

- by occupational category, the optimistic and pessimistic estimates of accumulated demand in the industrial port for 1990 and 2000, at constant levels of productivity, are the following:

Table 73 - Estimates of accumulative demand in the Lazaro Cardenas micro region (1990-2000)

Occupational Group	1990		2000	
	Low	High	Low	High
Professionals	4 250	5 070	8 870	11 090
- Science & eng.	2 130	2 520	4 420	5 470
- Admin. & acctg.	1 895	2 245	3 930	4 880
- Others 225	305	520	740	
Mid-level technicians	3 500	4 360	7 460	9 865
- Technicians	2 100	2 515	4 315	5 465
- Admin. assistants	1 400	1 845	3 145	4 400
Skilled workers	36 970	46 330	80 950	106 960
- Skilled labourers	33 130	41 290	72 290	94 910
- Office employees	3 840	5 040	8 660	12 050
Unskilled workers	17 100	18 600	35 000	38 300
Total	61 820	74 360	132 280	166 215

- although the tendency in the Conurbation will be towards a relative reduction in non-qualified occupations and an increase in those requiring high levels of qualifications, in the medium and long run, the volume of non-qualified jobs will be 27 per cent of the total employment in the year 2000, as compared to 42 per cent at present in the industrial sector. The demand in absolute terms will increase from 12,800 unskilled workers in 1982 to a low estimate of 35,000 and a high estimate of 38,300. The economic sector described as non-formal or traditional absorbs large portions of the labour force in the urban zones, and generates employment, especially in the services, in small informal businesses in the industrial centre, and in manufacturing and handicrafts in the tourist centre. Although the experts tend to classify this population as underemployed because of its occupational instability and low salaries, its comparative advantages for the rural population are perceived to be considerable because of the difficulty of finding employment in the agricultural sector. Unskilled occupations in the industrial sector are mainly simple assembly jobs in the construction industry, now 70 per cent of total employment in the industrial port, which even in the year 2000 will be generating 37 per cent of the jobs.

- the calculations of specialized agencies for the various occupational categories indicate that in the industrial sector the ratio between university graduates and technicians will be one to one in the short and medium terms. This runs counter to the expectations and calculations of those agencies that favour the expansion of technological education on the basis of a ratio of 5 technicians to each university graduate. The category that generates the greatest number of jobs is that of skilled workers, a subtle differentiation being formed regarding the definitions of 'technicians' and 'skilled workers' and the respective qualifications required. What is important to emphasize here is that a large number of graduates from middle-level technical schools can be incorporated into industry only as skilled workers.
- the estimates of the demand by occupational category in the industrial port at constant productivity according to the optimistic hypotheses indicate that the following specializations will be in greatest demand in the short term (1985):
- these estimates refer specifically to the demands of the industrial sector of the port. To them must be added the jobs that should be generated in the service area, especially those related to tourism. Rapid calculations indicate that the Conurbation could require between 3,500 (low) and 7,000 (high) primary school teachers by the year 2000 (not including activities such as kindergartens, special education, etc.) Requirements for secondary teachers should vary between 1,050 and 2,850, and the health sector will demand between 780 and 2,400 doctors. The tourist industry will require a more detailed analysis, because of its particularly rapid growth.

Table 74 - Lazaro Cardenas Micro region: Estimates of the demand for human resources according to occupational categories (1985)

Univ. Graduates		Mid-level Technicians		Skilled Workers	
Admin.	1 580	Admin.assists	740	Construction	10 880
Civil eng.	710	Tech.civil eng.	630	Metallurgy	5 660
Mechan.eng.	550	Technic.mech.	570	Mechan.& elect.	2 830
Accountants	500	Assist.account.	200	Office clerks	2 300
Elect.eng.	390	Elect.tech.	460	Drivers	2 130
Indus.eng.	170	Customs tech.	80	Construc. operators	740
Chem.eng.	60	Draftsmen	70	Lift operators	770
Metall.eng.	40	Metall.tech.	40	Longshoremen	340
Other eng.	300	Other tech.	170	Other	4 440
Others	140				
Total	4 440		2 960		30 090

- If present tendencies continue, and given the scarcity and hilliness of the land, lack of water, erosion, archaic land-ownership systems and modes of production, our estimation is that agricultural activities will be unable to absorb much manpower. Our opinion is that CONAPO's estimates of the absorption capacity of this sector -- especially in the industrial port hypothesis -- are very high. In the greater part of the zone, increases in productivity will be achieved through the use of more appropriate technology and better oeganization, especially in the ejidos. It is possible that in the medium term there will be problems of oversupply of manpower at low levels of qualification combined with shortages of highly-qualified personnel, but only if there were a radical change in agricultural strategy. The decisions regarding criteria for deforestation, grasslands, arable lands, the use of better seeds, fertilizers, marketing, etc. require qualified personnel in the ejidos. Advances in the application of science and technology to agricultural activities may mean that in the medium and long terms the present definition of "suitable agricultural land" will be obsolete or assessed on purely economic grounds. In a zone with such poor conditions for conventional agricultural production perhaps there is room for innovative exploration.

- the demand for skilled workers is that which will grow the fastest, and will be filled for the most part by immigrants from other regions of Mexico. Training will take place within those large industries that have their own job-training systems or that are co-operating with technological schools in the area. To put the local population in a more favourable position to compete for jobs, given that the educational qualifications required will rise, it will be necessary for the local schools to combine forces and achieve the required improvements. The observed tendencies toward diversification and specialization may be appropriate in the short run, but could cause major problems in the long run in a fluctuating job market.
- In the Conurbation in general, and in the micro region of Lazaro Cardenas in particular, the demand for university graduates has been filled exclusively by outsiders. Given the volume of population estimated for 1990 and 2000, the social and economic demand for university education will be acute. Taking as reference the more optimistic population estimates and estimating a 20 per cent penetration rate of 20 to 24-year-olds into the higher education system, there should be, by 1990, 22,000 young people demanding higher education, and there could be as many as 67,000 by 2000.
- an argument that reinforces the need to establish programmes of higher education in the zone is the fact that many of the specializations in which there will be shortfalls in the country as a whole by 1990 will be precisely those most in demand in the Conurbation - in the mining and metallurgy sector, the construction industry (civil engineers, public works engineers, and communications engineers), the processing industry (chemical, electro-mechanical, and industrial production engineers), and the trade and service sectors (accountants, economists, public administrators, medical doctors, secondary and university professors).

C. Technological innovation, productivity, formal education and training systems

In general, empirical evidence demonstrates correlations between the educational levels of the economically-active population and the rates of productivity. The most pronounced impacts are observed at the primary-school level, but the secondary and higher levels also correlate closely. Increases in the levels of education of specific occupations do not necessarily correspond to increases in productivity levels; in the relations between education and productivity, important factors - of which the organization of productive activities within the companies and the technical complexities of the jobs are most important - intervene.

The traditional concept of technology, which is having to do with machine and tools, has been extended in the modern sense to include means, processes, ideas, and forms of change and manipulation of the environment. Technology is incorporated not only into machines but into capital and human resources, and is even beginning to operate in the market place as merchandise. The relationships between technology and development are close and direct. At the same time, the technological supremacy of the developed countries and the mechanisms of its transference to less developed countries contribute to strengthening the phenomena of dependency. There arise, then, various questions: a) what is adequate technology? b) how is technology generated from within? c) what are the processes that lead to the generation of technology? d)what is the role of education in the generation of technology? e) how is technological development promoted within the factory? f) how are people trained to think, to be creative, to have the desire for innovation?

To be 'adequate', technology must correctly reflect capital/labour emphases, levels of economic productivity, and the latest advances possible. Imbalances at one extreme favour maximum use of labour whatever the cost to economic productivity, and at the other extreme prefer capital-intensive technologies without thought to the social costs in surplus manpower that cannot be employed elsewhere, or the cost of importing machinery, materials and technology, which generally leads to increases in the foreign debt of the country. To be adequate and appropriate, the technology level must reflect consideration of both social and economic costs, and must not reject scientific knowledge and advance. It must be harmonious with the evolution of the labour force. In the Conurbation, the 'fit' between capital and labour is not at present an acute problem; the region imports manpower. Here technology must be considered "inadequate", to the degree that it is imported wholesale, and that efforts to formulate policies that would encourage autonomy in technology in the foreseeable future are not apparent.

Sources of technological change are many, and the tendencies are toward less dependency on spontaneous activities and more on the specific, organized, continuous search for and production of technology. Technology is not a simple byproduct of scientific knowledge, nor is it the result of an emphasis on the technological formation of human resources. To generate technology from within implies the creation of infrastructure, and thence the formation of human resources, the organization of the activities of production, the definition of research policies, the co-ordinating of technological and scientific development with strategies for socio-economic development.

The role of education in generating technical progress is related on all levels of the educational system to the development of skills, knowledge, motivations and abilities which we have emphasized throughout this report. In the industrial sector there are three general types of enterprises: a) those oriented toward developing end-products on the base of imported technology or technological 'packages'; b) those that adapt existing products and processes; c) those that search for original products and new forms of production. In each kind of company the utilization of education, knowledge and skills is different; the more imitative the activities, the lower the educational requirements, and the more rapid the job-training; and the more innovative the activities, the higher the educational requirements and the great the demand for general knowledge and previous scientific and technological training.

If educational systems are planned according to the existing orientation of the industrial sector the vicious circle of dependency will be reinforced. Even in the most routine situations of production, in enterprises using all-imported technology, there are problems of maintenance and operation. In fact, key professional people in any enterprise are required to evaluate scientific and technological knowledge in the area of interest of the company, to solve new problems for their customers, to keep up with the competition, predict future events, etc. Any attempt to organize the development of institutions of higher learning in the Zone should take these factors into account, as well as those related to inter-institutional integration. Research on the academic and professional training of engineers and their capacity to adjust to the labour market and to innovative activities indicates that the weight of scientific components (the analytical tools that give the professional the capacity to understand theoretical problems as applied to his own discipline) are as or more important than technical-professional or technical-specialist considerations (the phenomena of the discipline or the speciality in which they are trained). This is particularly true in a dynamic and flexible labour market. In terms of curriculum organization the problem is one of balancing the three components, and designing activities that permit students to learn general principles and apply them to concrete or theoretical situations.

A number of questions arose from this study, having to do with the effective functioning and dynamics of relations within the school and the enterprises and between the two systems, which have not yet been dealt with. Our focus was rather on global questions related to the state-of-the-art in the areas concerned. Some of these questions, in our opinion, deserve attention, among which are the following:

- what indigenous technologies are being incorporated into the productive system?
- how can the bottlenecks in some stages of production be resolved?
- how can problems of quality of goods, cost reduction, and increments in productivity be resolved?
- what are the educational characteristics of the personnel working in the enterprise?
- what is taken into consideration in recruiting personnel? How are characteristics measured?
- are there preferences for graduates from any specific type of institution?
- what are the relations between the companies and the educational system?
- what learning and training processes are available in the workplace?
- what are the main problems facing the companies regarding the training provided by different kinds of schools?
- what are the principal problems and virtues in the academic education of the university graduates that contribute to or inhibit innovation and adaptation in the workplace?
- how relevant are the university studies offered on the regional, national, or international level?
- to what degree do the professionals in the various sectors of the companies participate?
- what are the criteria on which the specializations are established and the various programmes implemented in the school system? What weights are given to abstract or concrete components, to the scientific or technological factors, to the humanities, to general and to specialized knowledge?
- what are the concepts of 'technicians', 'technological', 'scientific', held by the various agents in the educational process and in the workplace?
- what percentage of graduates are directly incorporated into the productive system? Where? What percentage of them are employed directly on tasks related to their field of specialization?
- what is the graduates' opinion of their training?
- what are the occupational and income expectations of the students?

General comments and conclusions

The answers to these and other questions, through research in the Conurbation and other regions of Mexico where industry is being developed, will undoubtedly contribute to providing better qualitative elements in planning for industrialization, technical progress, and autonomy.

APPENDICES

Appendix to Chapter 2

Table A.2.1: Enrolment in the technological system by specialization (1978/79)

Level: Basic Middle (Technical Secondary)

Specialization	1	2	3	Total
Secretarial	18 431	14 889	12 453	45 773
Electrical	14 167	12 074	10 481	36 722
Industrial drawing	12 229	9 854	8 576	30 659
Clothing industry	9 996	7 641	6 892	24 509
Electronics	7 616	5 804	4 986	18 406
Automobile mechanics	6 684	5 168	4 581	17 033
Machine tooling and tuning	6 035	5 230	4 082	15 347
Carpentry	4 263	3 392	2 825	10 480
Accounting	11 559	--	--	11 559
Soldering and welding	1 693	1 389	1 207	4 239
Basic shop	875	883	753	2 511
English	535	466	395	1 396
Food prep. and conservation	415	485	391	1 291
Beauty culture	505	453	348	1 311
Ducts and controls	420	109	--	529
Dietetics	200	161	156	517
Sanitary and gas installation	285	249	215	749
Knitting	152	153	186	491
Advertising art	155	149	132	436
Typography	158	129	108	395
Air cond. and refrigeration	149	90	72	311
Casting and founding	114	98	88	300
Duct installation and control	96	89	73	258
Electrical installation	70	72	70	212
Lumber construction	75	66	60	201

23 other specializations are mentioned, of less than 200 students (for example, agriculture, graphic arts, bookbinding, costume jewellery, tailoring, tapestry weaving, etc.)

Table A.2.2: Enrolment in the Technological System by Specialization (1978/79)

Level: Upper Middle (Non-terminal) Industrial Technological

Specialization	No. of students enrolled
Accounting	16 297
Electromechanics	9 740
Clinical laboratory	9 221
Electronics	3 871
Internal combustion machinery	2 814
Electricity	2 701
Tourist administration	2 380
Bilingual exec. secretarial	1 523
Personnel administration	1 489
Air conditioning and refrigeration	1 355
Topography	1 309
Construction	1 305
Fermentation	992
Sales	867
Food science	777
Soils and fertilizers	762
Mechanics	661
Maintenance	631
Social work	532
Industrial maintenance	287
Clinical analysis	236
Mining	304
Lumber construction	111
Machine tooling	97
Instruments	64
Industrial security	50

Table A.2.3: Enrolment in the Technological Institutes of the National Directorate (1978/79)

Level: Upper Middle

Specialization	No. of students enrolled
Mechanics	5 318
Electronics	4 943
Telecommunications	4 809
Laboratory	4 320
Automechanics	3 492
Accounting	2 088
Construction	1 144
Personnel administration	891
Maintenance	748
Topography	629
Air conditioning & refrigeration	546
Electromechanical systems	469
Tourism	491
Commerce	435
Instruments	405
Paper	330
Steel	295
Automotive maintenance	230
Quality control	224

Twelve other specializations had less than 200 students.

Table A.2.4: Enrolment in Agricultural Technology by Specialization (1978/79)

Level: Upper Middle (Non Terminal)

Specialization	No. of students enrolled
Agricultural technology	15 493
Animal husbandry technology	14 029
Industrial agriculture technology	1 519
Fruit growing	1 353
Forestry	1 188
Agricultural Business Administration	1 138
Sugarcane technology	1 135
Topography	404
Agricultural machinery	130
Horticulture	98
Beekeeping	99

Table A.2.5: School enrolment in the Marine Sciences by Specialization (1978/79)

Level: Upper Middle

Specialization	No. of students enrolled
Fishing	542
Agriculture	492
Marine electrical equipment	469
Marine engines	329
Industrial fishing refrigeration	418
Fish products conservation	105
Administration of fishing co-ops	71

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Appendix to Chapter 4

Subzones in the agrarian sector of the Conurbation

Here we classify in detail some of the characteristics of the 13 subregions or micro-regions by physical characteristics, type of production, geographical relationship, the nature of community problems and the usual trading centres. Often these micro-regions go beyond the political boundaries of the countries and come together as a result of common recent or historic processes. For example, agrarian reform reached the coast earlier than it did the mountains. In our research we gathered information on 73 towns, only a few of which maintained close relations with the poles. These were subzones 1, 2 and 7. A little more than two-thirds of the population of the whole conurbation are in subzones 2 and 7 and are obviously close to the poles. Information was gathered by town, and questionnaires were answered by the community sheriffs. We did not request information on the active population or on the value of the productive activities of the area, which would have enriched the analysis considerably.

Subzone 1 includes the towns of Coacoyul, San Miguelito, Los Achotes and El Zarco. There were several ejidos, but we obtained information for only two of them. There was a fishing ejido (El Zarco), a fruit-growing enterprise, and another enterprise - which maintained relations with Productos Pesqueros Mexicanos (PROPEMEX), Banco Rural (BANRURAL) and the Programme of Investment for Rural Development (PIDER), respectively. Until 1979 there was a cattle-farming co-operative society promoted by the National Fund for Agrarian Reform Community Development (FONAFO) but it was unsuccessful because of a corrupt administration. Maize and beans, mainly for local consumption, and sesame are produced here. In El Zarco there is cattle-farming and fishing, and 60 hectares are dedicated to fruit growing: coconut, mango, guava, papaya, tamarind and lime. El Coacoyul is basically fruitgrowing: coconut, mango and tamarind. This is where the fruit-growers' company operates. There is some dairy farming, but the total daily milk production of only 150 litres is used entirely for local consumption. In San Miguelito maize, beans, sesame and a number of vegetables (chilis, tomatoes, radishes and artichokes) are grown.

Subzone 2 comprises those towns directly connected to Zihuatanejo: Barrio Nuevo, Barrio Viejo, Pantla, La Salitrera, Buena Vista and Agua de Correa. Until 1970 this subzone was connected to the rest of the country by dirt roads. Since then roads to Acapulco and Lazaro Cardenas have been built, and a highway is being built that will link it more directly with Mexico City via Toluca. The economic activity of the subzone gets its impetus basically from tourism and from the urban expansion of Zihuatanejo, which has engulfed the agricultural activities in the nearest towns. This process has taken place through the expropriation of large areas by the Zihuatanejo Bay Trusteeship (FIBAZI) and the National Tourist Fund (FONATUR). Agricultural development has been affected not only by the seizure of lands but also by the diversion of water resources towards the hotel zone. The nearest towns (Agua de Correa and Zihuatanejo) are losing their agricultural tendencies; others such as Pantla, Barrio Viejo and Barrio Nuevo still retain them, but they are not involved in local supply. There are fruit-growing, concrete-block, coconut-palm and cattle-farming enterprises; maize, beans, chilis and watermelon are produced. The most common plantations are coconut palms. There are cattle and some poultry. The irrigated zone of Barrio Nuevo and Barrio Viejo covers 90 hectares. The tourist area is not supplied by local production, however; fruit, vegetables and meat are brought from Mexico City, and some of the fish from Acapulco.

Subzone 3 comprises the towns of La Laja, Las Ollas, La Parota, Vallecitos de Zaragoza and Real de Guadalupe. It is connected more directly to the interior of the State of Guerrero than to Zihuatanejo. Mineral resources (gold, silver, zinc and copper) have been mined since the nineteenth century; they are delivered to the interior of the country via dirt roads. The building of a paved highway that will connect Zihuatanejo with Mexico City via Ciudad Altamirano, and that is in the process of being completed, will undoubtedly stimulate new growth in the area. PIDER and BANRURAL have made a number of investments in the area, mainly in cattle farming. Large timber works are being carried out, and the wood is processed in Tecpan de Caleana and Papanoa (towns in the State of Guerrero, outside the conurbation). Maize (mainly for local consumption) is the main crop in the area, although there are also beans, chilis, sesame and tomatoes. In Vallecitos de Zaragoza (the most active farming area) there are also rice and sugarcane plantations on a small scale. Cattle-farming, bee-keeping and poultry-farming are also to be found.

Subzone 4 comprises Chutla, Arroyo Grande, Lagunillas, El Tibor, Llanos de Temahuacan, La Salitrera and Buena Vista. Part of it lies on the coast, part in the mountains, and some of its towns (Chutla and Llanos de Temahuacan for example) are over one hundred years old. With the exception of Arroyo Grande, these lands used to be haciendas, but they are now ejidos. Relations are maintained with some of the agencies that have provided credit: PIDER, BANRURAL, Impulsora Cocotera Guerrerense and CONASUPO. There are three cattle-farming enterprises (Lagunillas, El Tibot and Buena Vista), fishing, and fruit-growing co-operatives such as Llanos de Temahuacan;

48% of the area used for short-cycle crops is planted in maize, 47% in sesame. Tomatoes, beans, sorghum and watermelon are also grown. Coconut is an important crop, and there are plantations of mango, tamarind and papaya. Cattle production is fairly significant, particularly in Lagunillas, where there are 1,200 head, the other ejidos averaging 600 head.

Subzone 5 includes the towns of Troncones, La Union, Joluta, Junta de los Rios, Rincon de Cucharatepec and Corral Falso-Limoncito. The ejido is the predominant form of land tenure, and crops in the zone are short-cycle. There are a number of ejidos, notably in La Union which is the municipal capital and centre of the subzone. A limestone mine is being worked under contract with SICARTSA, and most of the farmers in the ejido of Corral Falso work as miners, although here is agriculture and cattle-farming activity on a small scale, basically for local consumption.

In the subzone as a whole, the main short-cycle crops are sesame (60%) and maize (35%). The production of Rincon de Cucharatepec is the most varied: beans and watermelon constitute 60% of the crops, and it produces the largest share of the zone's sesame and maize (71% and 46%, respectively). Seventy hectares are planted in fruit trees, which constitute 37% of the permanent crops of the area and the area has the most extensive cultivated grasslands, 57% of which are devoted to intensive cattle-farming. It is the largest mango producer in the zone (10,000 cases a year), and there is a fishing ejido of eleven members, in which 60 of the ejido farmers' sons or daughters are employed.

Subzone 6 comprises the towns of La Salada, Feliciano and La Estancia. It is situated in the interior, near the watering system. The main short-cycle market crop is sesame, which covers 60% of the cultivated area, the rest being devoted to the production of maize for local consumption. There is some cattle-farming, and in Parota 100 hectares are devoted to cultivating permanent plantations - 80 hectares of tamarind and mango and 20 hectares of coconut.

Subzone 7 comprises the towns of Zorcua, San Francisco, Zacatula, El Naranjito, Las Tamacuas, El Huaricho, Acalpican, El Bordonal, Guacamayas, Buenos Aires, Playa Azul and Melchor Ocampo. This subzone is the more important to our work, as it is part of the district watered by the J.M. Morelos dam, and the agricultural centre of the region. It is also from here that most of the future fruit, vegetable and grain programmes may be developed to supply the company towns. Here we find flat lands, watering systems, plentiful highways and transport systems, markets, etc. All of the pertinent government agencies maintain close relations with private land owners and ejido farmers in the subzone.

Three factors combine here to prevent more rapid growth and diversification of farming activities:

- the established system or urban enclaves of the permanent coconut plantations on most of the fertile land, which renders the reorientation of production somewhat difficult. Not only are there economic risks, but entrenched customs are followed in the management of this type of plantation, whose maintenance is minimal and requires very little manual labour, and which does not suffer from the serious problems associated with intensive farming.
- the associated problems of monopolization, illegal speculation with ejidal land, ghost plantations that increase the cost of land compensation, etc.
- competition with the salaries being offered in the urban sector. The towns closest to Lazaro Cardenas house the workers of the industrial complex, and their higher salary levels cause inflation in the towns.

The water from the irrigation district is mostly used to increase the yield of existing plantations, although lately there has been more widespread planting of fruit trees such as banana, mango and papaya, either between the coconut palms or nearby. The considerable cost involved in building irrigation canals to the more distant regions has not been amortized because of the farmers' reluctance to use them.

Until 1980 only a very small area was used for vegetable growing, and at that time traditional short-cycle crops such as maize were rapidly losing ground to the fruit orchards. That year the area devoted to short-cycle crops was 543 hectares, and that for permanent crops was 6,000.

Of the 7,158 hectares cultivated (almost 8,000 registered), 5,761 were part of the ejido system, the rest private property. If we take into account only the formal distribution of the plots, we find that the ejidal system has become polarized: 127 well-off farmers with plots of more than 10 hectares control more than 40% of the land, while 655 less favoured farmers (with less than 5 hectares) control 30%; 220 poor farmers control the remaining 30%. The level of concentration is, in fact, even more serious for, apart from the formal aspect, land is being bought up or leased by community farmers or private landowners in what is called "acquisition of rights". The incorporation of a new, relatively dynamic, business stratum, the loss of official or real control by the small landowners (attracted by the capital associated with the non-traditional fruitgrowing activities) are the predominant tendencies in the social process resulting from the installation of the irrigation district and the urban expansion of Lazaro Cardenas.

The production of the subzone is significant - maize still occupies 36% of the artificially watered surface, and 74% of the naturally watered area devoted to short-cycle crops. In El Naranjito, bean and watermelons occupy 25 and 30 hectares, respectively. All the community plots have large fruit orchards, the most important being the Playa Azul, El Naranjito, Zacatula and Melchor Ocampo, with areas that range from 1,000 to 2,500 hectares. The rest of them are about 500 hectares. Although not on a particularly large scale, poultry-farming and beekeeping do exist.

All the ejidos have access to the watering system, but not in equal proportions. Those most favoured are in Guacamayas, Melchor Ocampo and Playa Azul, where 75% of the area is irrigated. In La Parota, El Naranjito, Zacatula and Acalpican about half is irrigated, and in the rest only 40%.

This subzone has the greatest share of farming machinery in the conurbation, but even here there is not very much. Naranjito has 7 tractors, Zacatula 10, Acalpican 4. All three have planters and cultivators. One of the reasons, however, is the socio-cultural attitudes of the farmers, who refuse to adopt new work habits or to use the machinery. In Naranjito, for example, we were informed that the tractors were not working because the farmers had not been able to come to an agreement with the technicians of the Ministry for Agriculture and Water Resources. Thus throughout the subzone, the incidence of working animals is high. Fertilizers are used on 15% of the area, and high-yield seed is used for all crops and most of the area sown. Technical advice is frequently sought, especially as regards the use of water, sowing methods, and the clearing and cultivation of land.

Subzone 8 comprises the towns of Chucutitan, Las Penas and Caleta del Campo which, with the completion of the highway between Lazaro Cardenas and Manzanillo, will become part of Subzone 7. There is no electricity and the crops are traditional. In Caleta del Campo there is fishing activity and its tourist potential (especially local) is great. For example, important programmes could be undertaken for the workers from the Lazaro Cardenas industrial sector.

Subzone 9 comprises the towns of Los Coyotes, El Reino, Arroyo de la Tierra, Los Anafres and Huicumo. It is situated in the hills near the basins of the J.M. Morelos dam and its activities include fishing as well as farming. BANRURAL, PROPEMEX and CONAFRUT have aided the development of organized activities in the area, which is hilly and steep.

Maize, sesame and tomatoes are sown on approximately 8% of the arable land; there are also coconut, mango and tamarind plantations, and there is cattle-farming in Los Coyotes and El Reino.

Subzone 10 comprises the towns of Arteaga, Las Hembrillas, La Espinoza and La Pareja, all within Arteaga county and situated high in the mountains. There are forestry, activities here. With the exception of Arteaga (an easily accessible urban centre), the towns suffer from problems in communication. The most important activity is livestock farming, which employs most of the population, as the land allotted to crop growing is minimal. Of the whole conurbation, historically this subzone is considered to be the bastion of Mexican conservatism, opposed to agrarian reform and strongly influenced by the Catholic church. This situation creates frequent and serious problems between private landowners and ejidatarios.

The most important crop is maize, which is sown on 85% of the cultivated area and consumed locally. The little remaining of the area is sown with beans. As we have mentioned, livestock farming is important; it includes dairy cows, pigs and goats. La Pareja produces most of the dairy cows, pigs and 80% of the avicultural production, which in fact is relatively insignificant (1,100 birds).

Subzone 11 comprises the towns of La Vinata, Las Canas, Las Balsas, Toluquilla, La Piterera (Infiernillo), Cerro de la Lumbre and El Sauz. Geographically dispersed, these towns are situated around the El Infiernillo dam basin. It is an extremely poor subzone, with scant agriculture and some fishing in the dam. Cattle farming is also meagre. Both agricultural and cattle-farming activities supply local markets, and only 915 hectares are planted in maize, sorghum, sesame and beans. Despite its proximity to the dam, the region's main problem is water.

Subzones 12 and 13: the first of these comprises the towns of El Platanillo, Galeana, Amatepec, Barrio de Guzman, Barrio de Lozano, Las Minitas, El Zopilote, Puerto Carrizo and Anton Simon. The second consists of Neuva Cuadrilla and Coyuquilla, and has more to do with La Union than with Coahuayutla county, where the towns of Subzone 12 are located. The main source of income is cattle-farming; there is very little communication with the rest of the conurbation, as access is by dirt road only, in a vehicle with a twin-traction engine. Four short-cycle crops are produced: peanuts, maize, sesame and beans. There are 18 ejidos, the largest of which are in Coahuayutla and Barrio de Guzman. The first has 600 arable hectares (400 planted in maize and 125 in peanuts), and the second has 331 (140 in maize, 150 in peanuts, and 40 in sesame). Drought and pests often ruin the crops.

In Nueva Cuadrilla and Coyuquilla maize and sesame are produced, along with a few cattle. There are also a number of permanent avocado, guava, mango and coconut plantations.

The cattle production of 5,000 head is concentrated around Coahuayutla. Machines are not used in working the land, and the local caciques control both transport and trade. The felling of trees on already precarious land, the scarcity of water, the social unrest due to authoritarianism and almost complete lack of communication are the most serious problems of this subzone, from which there is the highest incidence of emigration towards Mexico City and the US.

Appendix to Chapter 5

Evolution of the Population in the Conurbation

Details by county

A number of the most outstanding characteristics of the evolution of the total population is explained in detail below under counties.

Coahuayutla grew from a population of 9,546 in 1930 to 14,000 in 1980. The county is gegographically isolated and its production fairly stagnant; population increases are not parallel to variations in the economically active population. We analyzed the census data and found that in the period from 1930 to 1940 the population had increased by 3.8%, whereas the EAP for the same period increased by 1.6%. The population increase for 1940 to 1950 was also rather low (4.6%); the increase in EAP was somewhat higher (6.9%). For the 1950 to 1960 period the differences were wider - the population increased by 16.1%, the EAP by 45.8% - and still present in 1960-1970, when the population decreased by 11.3%, and the EAP by 48.8%. The data for 1970 to 1980 shows a population growth of 30%, but we do not have information on the EAP during this period.

The composition of the EAP of this county places it mainly in the primary sector, in the area of agro-industry. The social structure is homogeneous, the most relevant distinctions being between farmers with land, those without, and tradesmen. The distinctions are most clearly manifest in the differential distribution of power and money. However, if one relies on the usual means of detecting social differences, particularly lifestyle, it is virtually impossible to distinguish the various strata. Poverty tends to be generalised, even amongst those who have money. The houses are wooden huts with palm roofs and earthen floors, and there is no clear differentiation between the areas used for different purposes, such as kitchen and bedroom. The people defaecate outside, and their clothes are shabby. The difference is most visible at the storekeeper's (it is he who has most power (1)), where there is usually a truck or station-wagon. In the whole of the conurbation this zone is the only place where there is no urbanization, not even in the country capital.

José Azueta: attained the status of a country in 1973 and showed its most rapid growth beginning with tourist expansion in the capital and Ixtapa in 1974, and the creation of a modern tourist centre. In 1960 its population was 9,693, in 1970 it was 17,873 and by 1978 it was 35,000, an increase of 84.3% and 95.8% for each decade. The towns situated in the mountains have characteristics similar to those of Coahuayutla, although there is some mining, a vestige of the nineteenth century. There is growing urbanization, especially in Zihuatanejo, but population growth in the nearby towns continues to be anarchic. Basic services are almost non-existent, except for primary education. Social differentiation has become apparent only in Zihuatanejo, where different social strata are visibly distinguishable. Although a good number of workers are in the primary economic sector, the service sector continues to grow.

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(1) For further details, see Chapter 5.

La Union: as far as population is concerned, this area is similar to Coahuayutla, although it varies from decade to decade. During the decade 1930-1940 the area lost a quarter of its original population of 14,517, and regained it only in the 1970s. By 1950 the population had reached 13,192, but by 1960 it had again fallen to 10,300. The phenomenon can be explained by the division of the county in which a section of the population was included in José Azueta. The influence of population growth in the areas near the Lazaro Cardenas centre was reflected in an increase in population during the period 1970-1980. The evolution of the EAP did not correspond to variations in population; between 1930 and 1940 it decreased by 30.1%, and in the next two decades it increased by 26.8% and 25.6% respectively, increasing once more, though slightly (2.1%), between 1960 and 1970. Except in the towns near the industrial centre, the EAP is mainly in the primary sector.

Arteaga: the population of this area increased from 11,808 in 1930 to 14,780 in 1940, which meant a growth rate of 25.1% over the decade. From 1940 until 1950 the population remained stable, although one must take into account the division of the county and the new county of Melchor Ocampo del Balsas, which by 1950 already had 5,045 inhabitants. This county had the largest population in the conurbation during the 1940s and 1950s, and retained its role as a commercial and communiations centre. During the years from 1950 to 1960 there was a considerable drop in population, to 12,570. From 1960 onwards, normal growth was restored, gaining 31.3% between 1960 and 1970, and 28.5% between 1970 and 1980, to attain a population of 22,219 by 1980. As in other counties, there was no relationship between the total and the economically active populations. From 1960 to 1970, while the total population increased by 31.3%, the EAP decreased by 25.1%. It is debatable whether or not an error in census data can account for such marked variations, because the figures for the same year show a stagnation in farming production explained by a drop in production and productivity. Arteaga is a county in which the marjority of the EAP is involved in agricultural activities; there are hardly any secondary activities, and the service sector is concentrated in the capital.

Lazaro Cardenas: since its formation in 1947, this county has experienced dynamic growth; first because of sub-division of land under the agrarian reform, and second as a result of the industrial transformation that we are analyzing in detail. Between 1940 and 1950 the population rose by 100%; between 1960 and 1970 it increased by 215.67%, and by at least 150% between 1970 and 1980. Growth in the EAP is more closely related to total population here, in contrast to other counties. There is some imbalance between the numbers of men and women in the population; there were considerably fewer women than men during the 1970s, possibly because of the immigration of workers employed mainly in building the urban industrial infrastructure. However, as we will soon see, it would be unrealistic to suppose that these characteristics would persist for very long.

Another important characteristic of the county is the relative youthfulness of its population. This is a complex situation, because we are dealing not only with a migration of young workers but also with the fact that the ratio of inactive to active persons is considerably higher in the conurbation (4.49 per worker, 4.30 in Lazaro Cardenas) than the national average (3.82 inactive persons per workers). What is interesting here is that when the infrastructural works were in progress, not only did single workers and couples without families arrive, but also workers accompanied by relatives, many of whom settled in the micro-region in the inter-census period. CONAPO estimates that in 1950 only 711 families lived in the micro-region, and by 1980 the figure had risen to 15,000. In the 1970s, 91% of the almost 52,000 People who immigrated to the conurbation settled in the Lazaro Cardenas micro-region.

Appendix to Chapter 6

Table A.6.1: Elementary schools.- Total enrolment in 181 schools in five counties in the conurbation, by school year and sex, 1980-81

Course	Coahuayutla			Arteaga			La Union			Tte. J. Azueta			Lazaro Cardenas		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total	M	F	Total
1° years	578	475	1 053	520	519	1 039	944	860	1 804	1 144	1 068	2 212	1 949	2 040	3 989
2° years	322	297	619	322	268	590	670	599	1 269	705	738	1 445	1 540	1 406	2 946
3° years	181	171	352	228	222	450	517	436	953	690	637	1 327	1 291	1 269	2 560
4° years	122	91	213	196	209	405	417	414	831	566	527	1 093	983	914	1 897
5° years	116	55	171	193	151	344	344	339	683	502	424	926	824	691	1 515
6° years	45	58	103	105	96	201	221	231	452	401	360	761	622	642	1 264
Total	1 364	1 147	2 511	1 564	1 465	3 029	3 113	2 879	5 922	4 008	3 754	7 762	7 209	6 962	14 171

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Table A.6.2: Schoolrooms per school, in 181 schools in the conurbation, by county

Schoolrooms	Coahuayutla	Arteaga	La Union	Jose Azueta	Lazaro Cardenas	Total
1	14 (45.2)	5 (29.4)	23 (42.6)	3 (8.3)	3 (7.0)	48 (26.5)
2	9 (29.0)	6 (35.3)	10 (18.5)	5 (13.9)	6 (14.0)	36 119.9)
3	2 (6.5)	2 (11.8)	5 19.3)	2 (5.6)	2 (4.7)	13 (7.2)
4	1 (3.2)	- ( )	- ( )	7 (19.4)	4 (9.3)	12 (6.6)
5	2 (6.5	-	3 (5.6)	4 (11.1)	2 (4.7)	11 (6.1)
6	-	-	2 (3.7)	1 (2.8)	- ( )	3 (1.7)
7 and more	2 (6.5)	3 (17.7)	9 (16.7)	12 (33.3)	24 (55.8)	50 (27.6)
DK/NA	1	1	2	2	2	8
Total	31 (100.0)	17 (100.0)	54 (100.0)	36 (100.0)	43 (100.0)	181 (100.0)

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Table A.6.3: Pemex (Petroleos Mexicanos). Total Personnel trained in 1981, by occupational group

Occupational groups	Total personnel in the company								Total personnel trained			
	Under limited contracts(1)				Tenured(2)				Pemex training systems		Other training systems	
	Non-union		Union		Non-union		Union(3)					
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Managers					137	1			137	1		
Executives and consultants					544	8	369	5	617	13		
University graduates			1 064*	33*	2 056	203	2 365	232	14 179	1 402	866	86
Specialized personnel					931	152	13 108	1 296	4 989	554		
General personnel			70 000**		2 375	206	26 478	5 043	12 470	1 386		
Artisans					13		15 938	65	2 078	231		
Attendants					17		3 755	240	1 246	139		
Totals			71 064	33	6 073	570	62 013	6 881	35 716	3 726	866	86

(1) Temporary personnel.
(2) Permanent personnel.
(3) In Mexico high level personnel (handling confidential data and information) are non-unionized.

(*) Includes only personnel trained, not the total group.
(**) No information is available for transitory personnel.

Source: UCECA

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Table A.6.4: FERTIMEX, Coatzacoalcos Unit: Training Courses offered to the Personnel

a) Directors, Management and Department Heads
1. Development of leadership skills
2. Techniques of public speaking

b) University Graduates
1. Development of leadership skills
2. Technique of public speaking
3. Analysis of systems of administration
4. Public relations
5. Accounting principles
6. Identification of general services personnel and their jobs

c) Office of administrative employers
1. Development of leadership skills
2. Techniques of public speaking
3. Analysis of systems of administration
4. Accounting principles
5. Advanced spelling
6. Human relations
7. Induction
8. Identification of general services personnel with their jobs

d) Production supervisors or foremen
1. Development of leadership skills
2. Techniques of public speaking
3. Analysis of systems of administration
4. Human relations

e) Workers
1. Development of leadership skills
2. Techniques of public speaking
3. Analysis of systems of administration
4. Human relations
5. Induction
6. Siting principles
7. Payload technique and operations
8. Cutting and welding of stainless steel
9. Basic welding
10. Elementary chemistry
11. Handling and transportation of metals and heavy equipment
12. Repair and adjustment of centriguge separators

13. Rock filler dosage
14. Alignment of equipment and gear adjustment
15. Basic instrumentation
16. The painting of an industrial plant
17. Electricity - theory and practice
18. Capacitation in locomotive operation and maintenance
19. Capacitation and training of brakemen
20. Handling and maintenance of filling station equipment and shipment
21. Identification of general services personnel and their jobs

f) Service personnel

1. Development of leadership skills
2. Techniques of public speaking
3. Analysis of systems of administration
4. Public relations
5. Induction
6. Handling of maintenance of filling station equipment and shipment
7. Safety techniques
8. Identification of general service personnel with their jobs
9. Elementary chemistry

g) Assistant, maintenance or labourers

1. Induction
2. Basic boiling
3. Handling of maintenance of filling station equipment and shipment
4. Public relations

Table A.6.5: Profile of functions and occupational fields of upper middle-level CONALEP technicians specializing in metallic manufacturing

Professional functions of a Conalep technician	Functions of a Conalep technician in the industrial area	Specific functions of a technician specialized in metallic manufacturing	Industry
Co-ordinates and supervise labour	Organizes occupations	Interprets plans of parts	Metal mechanics
Selects, prepares and applies the necessary resources for achieving output and services	Takes the necessary measures for the effective operation of production	Makes drawings of complex formations	Automotive
Distributes and defines tasks	Explains operating procedures to the labourers	Makes sketch documents based on designs	Manufacturing
Assures the proper use of equipment	Assures the proper distribution of equipment	Solves complex problems of machine operation Helps to see that metals in plates or profiles conform to standards	Steel
Verifies the following of proper methods in the production process	Applies norms of hygiene and safety	Knows the mechanisms of tube manufacturing	Smelting
Takes care of Quality Control in products and services	Participates in the development of innovations for productivity	Applies techniques of joining, welding, riveting, etc.	Naval

Table A.6.6: Profile of functions and occupational field of upper middle-level CONALEP technicians specializing in metallic manufacturing

Professional functions of a Conalep technician	Functions of a Conalep technician in the industrial area	Specific functions of a technician specialized in metallic manufacturing	Industry
Co-ordinates and supervises labour	Organizes occupations	Determines the specifications for manufacturing engineering	Capital goods
Selects, prepares and applies the necessary resources for achieving output and services	Takes the necessary measures for the effective operation of production	Contributes to the design, control and assembling of special tools	Tool manufacturing
Distributes and defines tasks	Explains operating procedures to the labourers	Establishes documentation for the start-up and supervision of manufacturing	Structure manufacturing industries
Assures the proper use of equipment	Assures the proper distribution of equipment	Knows methods for conforming materials, obtaining raw materials, machinery, etc.	Farm machinery
Verifies the following of proper methods in the production process	Applies norms of safety and hygiene	Applies techniques of processing materials	Metal mechanics
Takes care of Quality Control in products and services	Participates in the development of innovations for productivity	Participates in the assembling of products Knows machinery and equipment used in the finishing of products	Automotive

Table A.6.7: Profile of functions and occupational field of upper middle-level CONALEP technicians specializing in welding

Professional functions of a Conalep technician	Functions of a Conalep technician in the industrial area	Specific functions of a technician specialized in welding	Industry
Co-ordinates and supervises labour	Organizes occupations	Determines the specifications for manufacturing engineering	Steel
Selects, prepares and applies the necessary resources for achieving output and services	Takes the necessary measures for the effective operation of production	Determines the specifications of manufacturing documents (instruction cards)	Smelting
Distributes and defines tasks	Explains operating procedures to the labourers	Knows techniques of materials processing	Metallurgy
		Applies welding techniques parts	Metal mechanics
Assures the proper use of equipment	Assures the proper distribution of equipment	Supervises finished products	Profile manufacturing
Verifies the following of proper methods in the production process	Applies norms of safety and hygiene	Knows techniques for material conformation	Manufacturing
Takes care of Quality Control in products and services	Participates in the development of innovations for productivity	Participates in the assembling of products	Automotive
		Knows machinery and equipment used in the finishing of products	

Table A.6.8: Programme of study and subjects for CONALEP technicians specializing in mechanics manufacturing

First Semester	Theory	Practice	Total
Man and technology	3	0	3
Foreign language I	1	2	3
Mathematics I	4	0	4
Physics I	1	2	3
Drawing I	0	4	4
Technological activities I and II	0	10	10
Chemistry	1	2	3
	10	20	30

Second Semester	Theory	Practice	Total
Reading and writing	3	0	3
Foreign language II	1	2	3
Mathematics II	4	0	4
Physics II	1	2	3
Drawing II	0	4	4
Technological activities III and IV	0	10	10
Industrial organization	3	0	3
	12	18	30

Third Semester	Theory	Practice	Total
Techniques of Bibliographical research	3	0	3
Applied mathematics I	3	0	3
Foreign language III	1	2	3
Industrial electricity	0	3	3
Design mechanics I	2	4	6
Manufacturing organization and design I	0	2	2
The processing of material I	0	1.5	1.5
Automation I	0	1.5	1.5
Technology and manufacturing workshop I	3	4	7
	12	18	30

Fourth Semester	Theory	Practice	Total
Contemporary civilization	3	0	3
Foreign language IV	1	2	3
Applied physics I	3	0	3
Metallurgy	3	0	3
Design and Mechanics II	2	4	6
Manufacturing organization and study II	2	0	2
The processing of materials II	0	1.5	1.5
Automation and manufacturing workshop II	0	1.5	1.5
	3	4	7
	17	13	30

Fifth Semester	Theory	Practice	Total
Labour legislation	3	0	3
Foreign language V	1	2	3
Quality control	3	0	3
Industrial electricity II	0	3	3
Design mechanics III	2	4	6
Manufacturing organization and study III	0	3	3
Processing of materials III	0	1.5	1.5
Automation III	0	1.5	1.5
Technology and manufacturing workshop III	2	4	6
	11	19	30

Sixth Semester	Theory	Practice	Total
Socio economic problems of Mexico	3	0	3
Foreign language VI	1	2	3
Costs and accounting	0	3	3
Industrial safety and hygiene	3	0	3
Design mechanics IV	2	4	6
The processing of materials IV	0	3	3
Manufacturing organization and study IV	0	1.5	1.5
Automation IV	0	1.5	1.5
Technology and manufacturing workshop IV	0	4	6
	14	16	30

Table A.6.9: CONALEP Programme of study and subjects for the specialization in port administration

First Semester	Theory	Practice	Total
Mathematics I	4	0	4
Administration I	3	0	3
Reading and writing workshop I	3	0	3
English I	3	0	3
Study techniques	3	0	3
Introduction to ports	3	0	3
Applied technical activities	0	8	8
	19	8	27

Second Semester	Theory	Practice	Total
Mathematics II	4	0	4
Administration II	3	0	3
Archives	2	2	4
English II	3	0	3
Correspondence and documentation	3	0	3
Human relations	3	0	3
Accounting I	2	4	6
Communication	3	0	3
	23	6	29

Third Semester	Theory	Practice	Total
Mercantile calculus I	4	0	4
Warehousing and inventory	3	0	3
English III	3	2	5
Introduction to transport systems	3	0	3
Ports I	0	10	10
Accounting II	2	4	6
	15	16	31

Fourth Semester	Theory	Practice	Total
Mercantile calculus II	4	0	4
Labour legislation and social security	3	0	3
English IV	3	2	5
Ports II	0	10	10
Maritime transport	3	0	3
Cost and accounting	2	4	6
	15	16	31

Fifth Semester	Theory	Practice	Total
Industrial relations I	3	0	3
Office organization	3	0	3
Maritime legislation	3	0	3
English V	3	4	7
Fiscal legislation	3	0	3
Socio economic problems of Mexico	3	0	3
Comparative accounting	2	4	6
	20	8	28

Sixth Semester	Theory	Practice	Total
Transport systems operation	4	0	4
Financial state analysis	4	0	4
Port administration	3	0	3
English VI	3	4	7
Warehouse controls I	0	5	5
Contemporary culture and civilization	3	0	3
Selected topics of port administration I	4	0	0
	21	9	30

Seventh Semester	Theory	Practice	Total
The maritime economy	3	0	3
Administration practices	2	4	6
Hygiene and port safety	3	0	3
Commerce	4	0	4
Warehousing II	0	5	5
Personnel management	3	0	3
Selected topics of administration II	4	0	4
	19	9	28

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Table A.6.10: CONALEP Programme of study and subjects for the specialization in metallic manufacturing

First Semester	Theory	Practice	Total
Man and technology	3	0	3
Foreign language	1	2	3
Mathematics I	4	0	4
Drawing I	0	4	4
Dimensional metrology	1	3	4
Technological activities	2	12	14
Drafting I	0	4	4
	11	21	32

Second Semester	Theory	Practice	Total
Reading and writing	3	0	3
Foreign language II	1	2	3
Mathematics II	4	0	4
Physics	1	3	4
Drawing II	0	4	4
Technological activities II	2	12	14
	11	21	32

Third Semester	Theory	Practice	Total
Public relations	3	0	3
Foreign language III	1	2	3
Scientific methodology	3	0	3
Industrial organization	3	0	3
Mechanics and design	0	5	5
Sketching and cutting	1	2	3
The processing of materials I	1	1	2
Technology and manufacturing worksnop I	3	5	8
	15	15	30

Fourth Semester	Theory	Practice	Total
Psychology	3	0	3
Foreign language IV	1	2	3
Projects methodology	3	0	3
Chemistry	1	2	3
Design and mechanics II	0	5	5
Sketching and cutting II	1	2	3
Processing of materials II	1	1	2
Technology and manufacturing workshop II	3	5	8
	13	17	30

Fifth Semester	Theory	Practice	Total
Contemporary civilization and culture	3	0	3
Sociology	3	0	3
Industrial safety and hygiene	3	0	3
The organization of work	3	0	3
Design mechanics III	0	6	6
Tracing and cutting III	1	2	3
Technology and manufacturing workshop III	3	5	8
Metallurgy	3	0	3
	19	13	32

Sixth Semester	Theory	Practice	Total
Socio economic problems of Mexico	3	0	3
Labour and accounting	3	0	3
Quality control	3	0	3
Mechanics and design IV	0	6	6
Sketching and cutting IV	1	2	3
Technology and manufacturing workshop IV	3	5	8
Costs and accounting	3	0	3
	16	13	29

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Table A.5.II: CONALEP Programme of study and subjects for the specialization in heavy construction

First Semester	Theory	Practice	Total
Applied mathematics I	4	0	4
Technical drawing I	0	3	3
Man and technology	3	0	3
Introduction to construction	3	0	3
Technological activities I	0	13	13
Administration O	13	16	29
	13	16	29

Second Semester	Theory	Practice	Total
Applied mathematics II	4	0	4
Technical drawing II	0	3	3
Sociology of industrial life	3	0	3
Administration of material construction	3	1	3
Technical activities II	0	13	13
	12	17	29

Third Semester	Theory	Practice	Total
Reading and writing workshop	3	0	3
Graphic methods and plan (drawing) interpretation	0	4	4
Hygiene and safety	3	0	3
Legislation on construction	3	0	3
Behaviour of materials	2	2	4
Topography	2	8	10
	13	14	17

Fourth Semester	Theory	Practice	Total
Contemporary civilization and culture	3	0	3
Construction material laboratory	1	2	3
Heavy machine construction equipment I	1	2	3
Accounting	3	0	3
Material resistance	2	4	6
Heavy construction methods I	4	6	10
	14	14	28

Fifth Semester	Theory	Practice	Total
Socio economic problems of Mexico	3	0	3
Professional ethics	3	0	3
Heavy machinery construction II	1	2	3
Cost analysis I	3	0	3
Introduction to soil mechanics	2	4	6
Heavy construction methods II	4	6	10
	16	12	28

Sixth Semester	Theory	Practice	Total
Construction control	2	1	3
Quality control	3	0	3
Manufacturing and handling of concrete	0	3	3
Cost analysis II	3	0	3
Construction systems analysis	2	4	6
Field practices	0	9	9
Human relations I	3	0	3
	13	14	30

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Appendix to Chapter 7

Table 4.7.1: Supply and demand for university graduates in Mexico, 1980 and 1992

	Specialization	1980			1992		
		Supply	Demand	Difference	Supply	Demand	Difference
I.	Agriculture	21,205	24,311	-3106	55,734	51,094	4640
1.	Agronomy	13,801	14,600	-799	25,888	30,515	-4627
2.	Agrobiology	4	6	-2	154	16	138
3.	Edaphology	759	1005	-250	1821	2107	-286
4.	Phytotechnology	4986	6572	-1586	19,354	13,679	5355
5.	Fruit growing	411	517	-106	2146	1165	981
6.	Agroparasitology	821	1000	-179	5049	2202	2847
7.	Agriculture	20	28	-8	262	69	173
8.	Irrigation, water conservation and infrastructure	333	464	-131	1181	1090	131
9.	Farming equipment	76	119	-43	199	271	-72
II.	Livestock	16,802	17,390	-588	54,888	35,999	18,889
10.	Fodder	3084	3689	-605	9986	7654	1332
11.	Zootechny and veterinary science	13,718	13,701	17	45,702	28,345	17,357
III.	Sylviculture	422	900	-478	1405	1091	314
12.	Sylviculture	422	900	-478	1405	1091	314
IV.	Fishing	377	494	-117	3691	1345	2346
13.	Capture	227	275	-48	1030	770	260
14.	Marine biology	150	219	-69	2661	575	2086
V.	Administration and rural development	578	741	-163	4928	1739	3189
15.	Agricultural administration	327	377	-50	2566	876	1690
16.	Agriculture and livestock administration	37	46	-9	1014	106	908
17.	Agric., livestock and fishing administration	21	37	-16	1195	95	1100
18.	Rural development	193	281	-88	155	664	-509
I-V	Primary activities	39,384	43,436	-4052	120,644	91,268	29,376
VI.	Extraction	4071	4555	-484	7759	9961	-2202
19.	Mining	880	1049	-169	1226	2227	-1001
20.	Mining and metallurgy	705	830	-125	1290	1779	-489
21.	Geology	2486	2680	-194	5244	5961	-717
VII.	Petroleum	1062	1130	-68	3893	2590	1261
22.	Oil exploration	9	11	-2	151	27	124
23.	Oil exploitation	832	873	-41	3144	1992	1152
24.	Oil transformation	221	246	-25	958	971	-13
VIII.	Electricity	5500	5224	276	12,381	11,536	845
25.	Production	5399	5103	296	11,743	11,265	478
26.	Administration	101	121	-20	638	271	367
IX.	Construction	74,646	86,024	-11,378	169,769	179,057	-9288
27.	Hydraulic engin. 9	2452	2875	-423	2705	5796	-3091
28.	Communication engin.	6722	7898	-1176	10,129	15,987	-5858
29.	Civil engineering	43,004	49,645	-6641	88,856	102,485	-13,629
30.	Rural engineering	154	217	-63	5260	472	4788
31.	Public works	7408	10,440	-3032	7327	22,443	-15,116
32.	Urban engin.	14,906	14,949	-43	57,492	31,874	25,618
VI-IX	Extraction, Energy Construction	85,279	96,933	-11,654	47,977	48,174	-8655
X.	Food production	1051	1268	-217	4986	2836	2150
33.	Agroindustry	163	198	-35	667	456	211
34.	Food technology	315	377	-62	1848	833	1015
35.	Biotechnology	319	388	-69	1510	869	641
36.	Bromatology	254	305	-51	961	678	283
XI.	Textiles	1822	940	882	2397	2149	248
37.	Production	1813	932	881	2295	2129	166
38.	Design	9	8	1	102	20	82

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Table 4.7.1: Supply and demand for university graduates in Mexico, 1980 and 1992 (continued)

	Specialization	1980			1992		
		Supply	Demand	Difference	Supply	Demand	Difference
XII.	Forest by-products	314	355	-41	1682	746	936
39.	Wood technology	301	338	-37	1468	704	764
40.	Paper technology	9	12	-3	131	29	102
41.	Furniture design and related subjects	4	5	-1	63	13	50
XIII.	Chemical	32,400	33,350	-950	65,172	74,141	-8970
42.	Chemistry	4007	3802	205	6229	8304	-2075
43.	Biochemistry	3844	3909	-65	7482	8540	-1058
44.	Pharmacy	1807	2257	-450	4356	4932	-576
45.	Chemical engineering	16,517	17,101	-584	31,786	38,162	-6376
46.	Industrial chemistry	5413	5588	-175	13,106	12,632	474
47.	Chemical processes	135	123	12	567	276	291
48.	Chemical administration	677	570	107	1646	1295	351
XIV.	Metallurgic Industries	1189	1368	-179	3772	3130	642
49.	Metallurgy	865	1009	-144	2405	2346	59
50.	Steel	83	93	-10	193	211	-18
51.	Chemical metallurgy	241	266	-25	1174	573	601
XV.	Machinery, electronic equipment and electricity	53,463	56,062	-2599	123,928	129,084	-5156
52.	Mechanics	12,180	11,526	654	23,251	26,129	-2878
53.	Metal mechanics	134	157	-23	655	375	-280
54.	Electromechanics	21,678	23,917	-2239	42,496	54,059	-11,563
55.	Electromechanical design	30	33	-3	435	807	-372
56.	Industrial engineering	12,643	13,877	-1234	32,156	32,229	-73
57.	Electronic engineering	1626	1723	-97	4501	4060	441
58.	Electronic instrument eng.	65	81	-16	435	201	234
59.	Industrial design	1001	1025	-24	3369	2519	850
60.	Naval and aeronaut. eng.	347	364	-17	1293	939	354
61.	Mechanical administration	1585	1607	-22	4692	3769	923
62.	Electromechanical admin.	24	32	-8	193	414	-221
63.	Industrial administration	2150	1720	430	10,452	3583	6869
X-XV	Transformation	90,239	93,343	-3104	201,937	212,086	-10,149
VI-XV	Secondary Activities	175,518	190,276	-14,758	396,699	415,231	-18,532
XVI.	Transportation	474	803	-329	3180	2024	-1156
64.	Engin. in transportation	18	18	0	673	46	627
65.	Engin. naval machinery	456	785	-329	2507	1978	529
XVII.	Communications	7587	11,198	-3611	20,281	26,587	-6306
66.	Electronics communications	7587	11,198	-3611	20,281	26,587	-6306
XVIII.	Tourism	1837	3965	-2128	14,607	7848	6759
67.	Tourism administration	1837	3965	-2128	14,607	7848	6759
XIX.	Entertainment	155	260	-105	903	565	338
68.	Entertainment	155	260	-105	903	565	338
XX.	Commerce	88,272	104,635	-16,361	143,764	221,021	-77,257
69.	Accounting	83,769	100,034	-16,265	133,828	210,892	-77,064
70.	Advertising and marketing	4503	4601	-96	9936	10,129	-193
XXI.	Finance	44	226	-182	383	474	-91
71.	Finance	44	226	-182	383	474	-91
XXII.	Other services	5989	6446	-457	31,844	14,631	17,213
72.	Engineering in computers and systems	840	3380	-2540	9037	7226	1811
73.	Communication sciences	4581	2127	2454	17,843	5251	12,592
74.	Graphics	494	535	-41	4095	1311	2784
75.	Decorating and design	74	404	-330	869	843	26
XXIII.	Administration	34,763	28,692	6071	77,089	62,118	14,971
76.	Administration	32,588	26,812	5776	67,356	58,086	9270
77.	Personnel administration	2131	1811	320	9266	3870	5396
78.	Public relations	44	69	-25	477	162	315
XVI-XXIII	Private services	139,123	156,225	-17,102	292,061	335,268	-43,207

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Table A.7.1: Supply and demand for university graduates in Mexico, 1980 and 1992 (continued)

	Specialization	1980			1992		
		Supply	Demand	Difference	Supply	Demand	Difference
XXIV.	Public administration	77,442	88,836	-11,383	214,163	187,513	26,650
79.	Political and public administration	4154	7873	-3719	7180	16,602	-9422
80.	Law	51,913	53,594	-1631	148,097	112,572	-35,525
81.	Economics	16,676	22,617	-5941	43,671	47,906	-4335
82.	International relations and foreign trade	1101	1740	-639	5949	4015	1934
83.	Demography, statistics actuarial	1401	798	613	4451	1792	2659
84.	Customs	285	285	0	612	612	0
85.	National defence	582	582	0	1215	1215	0
86.	National armada	1309	1309	0	2728	2728	0
87.	Remote sensing and meteorology	21	38	-17	360	71	289
XXV.	Public health	166,283	158,797	7486	354,783	342,338	12,445
88.	Medicine	113,562	107,217	6345	213,834	224,397	-10,563
89.	Odontology	29,691	30,538	-847	75,312	72,173	3139
90.	Obstetrics	95	147	-52	655	347	303
91.	Nursing	1220	1597	-377	7205	3299	3906
92.	Clinical analysis	10,894	10,533	361	32,156	21,302	10,854
93.	Optometry	409	355	54	1024	741	283
94.	Clinical psychology	9960	7701	2259	22,416	18,323	4093
95.	Ecology	4	6	-2	130	17	113
96.	Nutrition	409	630	-221	1770	1535	235
97.	Biomedical research	39	73	-34	281	204	77
XXVI.	Education sector (A)	15,253	19,681	-4428	132,901	53,582	79,319
98.	Basic education	998	1992	-994	3717	5568	-1851
99.	Normal	11,533	13,064	-1531	121,196	36,466	84,730
100.	Educational psychology	2718	4617	-1899	7736	11,525	-3789
101.	Vocational orientation	4	8	-4	252	23	229
XXVII.	Education sector (B)	10,620	17,659	-7039	32,020	45,163	13,143
102.	Biology	4733	6999	-2266	17,138	17,099	39
103.	Geography & oceanography	1553	2615	-1062	5679	6489	-810
104.	Physics	2405	4432	-2027	4470	11,849	-7379
105.	Mathematics	1428	2659	-1231	3307	7098	-3791
106.	Physical eng. & geophysics	501	954	-453	1426	2628	-1202
XXVIII.	Education sector (C)	18,781	26,786	-8005	46,072	64,663	-18,591
107.	Anthropology	3736	5856	-2120	10,423	13,842	-3419
108.	Sociology	4393	6311	-1918	15,755	13,898	1857
109.	Philosophy	4707	4109	598	7536	4178	3358
110.	History	2729	4897	-2168	5119	18,237	-13,118
111.	Languages and translations	569	1098	-529	2790	3007	-217
112.	Literature	2647	4515	-1868	4449	11,501	-7052
XXIX.	Education sector (D)	1384	1431	-47	4747	3359	1388
113.	Visual arts	1192	1065	127	1831	1870	-39
114.	Theatre	64	110	-46	1209	774	435
115.	Dance	31	61	-30	659	170	489
116.	Music	97	195	-98	1068	545	503
XXX.	Education sector (E)	331	604	-273	1452	1582	-130
117.	Archives & library sciences	327	164	163	1174	1559	-385
118.	Administration and educational planning	4	440	-436	278	23	255
XXVI-XXX	Educational sector	46,369	66 161	-19,792	217,442	170,349	46,893
XXIV-XXX	Public sector	290,105	313,794	-23,689	786,188	700,200	85,988
XVI-XXX	Tertiary sector	409,228	470,019	-60,791	1,078,249	1,035,468	42,781
	Total	644,130	703,731	-59,601	1,995,235	1,539,963	55,272

Source: Provisional calculations by SEP

Table A.7.2: Accumulated demand for university graduates in the construction industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Sciences & engineering	545	560	574	1 448	1 487	1 526
Civil engineers	529	337	346	647	664	681
Electrical engineers	77	79	81	274	282	2896
Mechanical engineers	90	93	95	341	350	359
Other	50	51	52	186	191	197
Administration and accounting	425	436	447	1 412	1 450	1 487
Masters in admin.	361	371	380	1 200	1 232	1 264
Accountants	64	65	67	212	218	223
Other	---	---	---	---	---	---
Total	970	996	1 021	2 860	2 937	3 013

Source: Mexico 1982

Table A.7.3: Accumulated demand for mid-level technicians in the construction industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Technicians	437	450	463	1 410	1 447	1 484
Techniques in civil engineering	233	240	247	566	582	597
Techniques in topography	47	49	51	144	148	152
Techniques in mechanics	84	87	89	375	385	394
Techniques in electricity	73	74	76	325	332	341
Total	437	450	463	1 410	1 447	1 484

Source: Mexico 1982

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Table A.7.4: Accumulated demand for qualified personnel in the construction industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Skilled workers	7 821	8 051	8 280	12 252	12 616	12 976
Construction workers	7 043	7 251	7 459	9 580	9 872	10 163
Mechanics & electricians	172	177	181	859	881	902
Transportation vehicle operators	372	384	395	1 063	1 095	1 126
Construction equipment operators	175	180	185	605	623	640
Other	59	59	60	145	145	145
Office clerks	---	---	---	---	---	---
Total	7 821	8 051	8 280	12 252	12 616	12 976

Source: Mexico 1982

Table A.7.5: Accumulated demand for human resources in the construction of port infrastructure, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates							
	1982		1985		1990		2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Engineers & technicians	48	52	48	50	35	37	53	61
Engineers	21	22	21	22	15	16	25	26
Civil	15	15	15	15	11	11	18	19
Mechanical	3	4	3	4	2	3	4	4
Electrical	3	3	3	3	2	2	3	3
Technicians	27	30	27	30	20	21	33	35
Civil	12	13	12	13	9	9	14	15
Topographers	7	7	7	7	5	5	8	8
Mechanics	5	6	5	6	4	4	6	7
Electricians	3	4	3	4	2	3	4	4
Admin. and accounting	9	9	9	9	6	7	11	11
Skilled workers	480	504	480	504	352	369	578	608
Construction workers	391	410	391	410	286	300	470	494
Construction equipment workers	23	24	23	24	17	17	27	29
Transportation vehicle workers	61	64	61	64	45	47	73	77
Other	6	6	5	6	4	5	7	8
Unskilled workers	436	458	436	458	320	336	525	552
Other	117	123	117	123	86	90	141	147
Total	1 091	1 145	1 091	1 145	799	839	1 313	1 379

Source: Mexico 1982

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Table A.7.6: Accumulated demand for human resources in the construction of urban & industrial infrastructure, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates							
	1982		1985		1990		2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Engineers & technicians	82	90	82	94	54	57	37	43
Engineers	51	56	51	58	33	35	23	27
Civil	37	42	37	43	25	26	17	20
Mechanical	9	9	9	9	6	6	4	5
Electrical	5	5	5	6	2	3	2	2
Technicians	31	34	31	35	20	21	14	16
Civil	20	22	20	23	13	14	9	11
Topographers	7	8	7	8	5	5	3	4
Mechanics	2	2	2	2	1	1	1	1
Electricians	2	2	2	2	1	1	1	1
Skilled workers	1 268	1 402	1 268	1 454	831	881	570	669
Construction workers	1 119	1 237	1 119	1 248	730	774	497	586
Construction equipment workers	34	38	34	40	23	24	15	18
Transportation vehicle workers	103	113	103	115	67	72	47	54
Other	12	14	12	15	11	11	11	11
Unskilled workers	526	582	526	603	345	365	236	278
Other	127	140	127	146	83	88	57	65
Total	2 052	2 268	2 052	2 352	1 345	1 425	922	1 083

Source: Mexico 1982

Table A.7.7: Accumulated demand for human resources in the construction of services to the population, Lasaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates							
	1982		1985		1990		2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Engineers & technicians	15	16	25	26	13	14	13	13
Engineers	10	11	16	17	9	9	9	9
Civil	7	8	12	12	6	6	6	6
Mechanical	1	1	1	1	1	1	1	1
Electrical	1	1	1	1	1	1	1	1
Other	1	1	2	3	1	1	1	1
Technicians	5	5	9	10	5	5	4	4
Civil	3	3	7	7	4	4	3	3
Topographers	1	1	1	1	1	1	1	1
Mechanics	--	--	1	1	--	--	--	--
Electricians	1	1	1	1	--	--	--	--
Admin. and accounting	4	4	7	8	4	4	4	4
Skilled workers	193	202	322	338	174	183	163	171
Construction workers	183	192	307	318	164	173	153	161
Construction equipment workers	2	2	3	4	2	2	2	2
Transportation vehicle workers	8	8	12	16	8	8	8	8
Unskilled workers	313	328	321	547	282	296	263	277
Other	22	24	37	39	20	21	19	19
Total	547	574	912	958	493	518	461	484

Source: Mexico 1982

Table A.7.8: Accumulated demand for human resources in the construction of housing, schoolrooms, and health infrastructure, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates							
	1982		1985		1990		2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Engineers and technicians	370	389	370	389	255	263	608	638
Engineers	238	250	237	250	164	172	391	411
Civil	190	199	190	199	131	138	313	329
Mechanical	14	15	14	15	10	10	23	25
Electrical	21	23	21	23	15	15	35	37
Other	12	13	12	13	8	9	20	20
Technicians	132	139	132	139	91	95	217	228
Civil	116	122	116	122	80	84	190	200
Topographers	8	9	8	9	6	6	13	14
Mechanics	4	4	4	4	3	3	7	7
Electricians	4	4	4	4	3	3	7	7
Admin. and accounting	112	117	112	117	77	81	183	192
Skilled workers	4813	5043	4813	5043	3313	3477	7899	8295
Construction workers	4757	4995	4757	4995	3274	3437	7808	8199
Construction equipment workers	8	8	8	8	6	6	13	14
Transportation vehicle workers	28	29	28	29	19	20	46	48
Other	10	11	10	11	14	14	33	34
Unskilled workers	7780	8169	7780	8169	5354	5622	12,771	13,410
Other	563	581	563	581	381	400	908	937
Total	13,618	14,299	13,613	14,299	9372	9841	22,354	23,472

Source: Mexico 1982

Table A.7.9: Accumulated demand for human resources in the construction & industrial assembling, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates							
	1982		1985		1990		2000	
	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic
Engineers & technicians	467	491	2 333	2 449	1 380	1 450	2 642	2 774
Engineers	225	236	1 123	1 179	664	698	1 271	1 335
Civil	79	83	393	412	232	244	445	467
Mechanical	63	66	314	330	186	196	356	374
Electrical	50	52	247	259	146	154	280	294
Other	34	35	169	178	100	104	190	200
Technicians	242	255	1 210	1 270	716	752	1 371	1 439
Civil	82	87	411	432	243	256	466	489
Topographers	24	26	121	127	72	75	137	144
Mechanics	73	77	363	381	215	226	412	432
Electricians	63	65	315	330	186	195	356	374
Admin. and accounting	247	259	1 231	1 293	729	765	1 394	1 465
Skilled workers	1 076	1 132	5 368	5 636	3 177	3 336	6 081	6 385
Construction workers	603	634	3 006	3 156	1 779	1 868	3 405	3 576
Construction equipment workers	108	113	537	564	318	334	608	639
Transportation vehicle workers	172	181	859	902	508	534	973	1 021
Electricians	75	79	376	395	222	234	426	447
Mechanics	97	102	483	507	286	300	547	574
Others	21	23	107	112	64	66	122	128
Unskilled workers	1 913	2 008	9 542	10 020	5 649	5 932	10 811	11 352
Others	566	592	2 826	2 967	1 674	1 754	3 204	3 363
Total	4 269	4 482	21 300	22 365	12 609	13 240	24 732	25 339

Source: Mexico 1982

Table A.7.10: Personnel required for the construction of Sicarsta's second stage annual programme

	1980	1981	1982	1983	1984	1985
			1. Sicarsta's Personnel			
University graduates	7	15	80	595	595	450
Administrative personnel	15	25	300	450	450	500
Technicians	15	30	40	430	430	200
Workers	100	350	500	1 295	1 295	1 150
	137	420	920	2 770	2 770	2 300
			2. Sub-contractors			
University graduates	5	55	250	500	400	50
Administrative personnel	20	75	500	750	500	250
Technicians	10	150	250	720	330	200
Workers	500	5 300	13 000	16 000	8 000	3 000
	535	5 580	14 000	17 970	9 230	3 500
Total	672	6 000	14 920	20 770	12 000	5 800

(1) Source: Technical Management, Sicarsta

Table A.7.11: Accumulated demand for university graduates for the steel industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Sciences & engineering	---	---	---	160	169	165
Civil	---	---	---	10	11	10
Electrical	---	---	---	17	18	18
Mechanical	---	---	---	26	28	27
Industrial	---	---	---	54	57	56
Chemical	---	---	---	9	10	9
Metallurgy	---	---	---	23	24	24
Other	---	---	---	21	21	21
Admin. and accounting	---	---	---	135	142	138
Masters in admin.	---	---	---	29	31	30
Accountants	---	---	---	106	111	103
Other	---	---	---	25	27	26
Total	---	---	---	320	338	329

Source: Mexico, 1982.

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Table A.7.12: Accumulated demand for mid-level technicians for the steel industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Technicians	---	---	---	98	104	101
Civil eng.	---	---	---	[illegible]	8	7
Mechanics	---	---	---	19	20	20
Electricity	---	---	---	15	16	15
Metallurgy	---	---	---	22	23	23
Industrial chemistry	---	---	---	6	[illegible]	9
Other	---	---	---	29	30	30
Administrative assistants	---	---	---	152	160	157
Accounting assistant	---	---	---	40	42	41
Administration assistant	---	---	---	112	118	116
Total	---	---	---	250	258	254

Source: Mexico, 1982.

Table A.7.13: Accumulated demand for qualified personnel for the steel industry, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Skilled workers	---	---	---	3 475	3 666	3 571
Construction workers	---	---	---	264	278	271
Mechanics and electricians	---	---	---	306	325	315
Transportation vehicle workers	---	---	---	329	347	338
Metallurgy workers	---	---	---	2 039	2 151	2 095
Seamen	---	---	---	537	567	552
Office clerks	---	---	---	445	469	457
Total	---	---	---	3 920	4 135	4 028

Source: Mexico, 1982.

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Table A.7.14: Accumulated demand for other industries, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates		
	1985		
	Pessimistic	Optimistic	Average
Sciences and engineering	73	292	235
Civil engineering	3	6	5
Electrical engineering	20	34	27
Mechanical engineering	15	24	20
Industrial engineering	16	27	21
Chemical engineering	5	9	7
Naval engineering	10	14	12
Other	4	6	5
Admin. and accounting	68	113	90
Masters in administration	58	97	77
Accountants	10	16	13
Other	36	59	48
Total	177	292	235

Source: Mexico 1982

Table A.7.15: Accumulated demand for mid-level technicians for other industries, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates		
	1985		
	Pessimistic	Optimistic	Average
Technicians	130	215	173
Civil eng.	10	14	11
Mechanics	34	58	47
Electricians	35	61	49
Naval	16	21	18
Draftsmen	28	38	49
Other	7	12	10
Administrative assistants	166	273	219
Accounting assistant	24	39	31
Administration assistant	142	148	234
Total	296	488	392

Source: Mexico 1982

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Table A.7.16: Accumulated demand for qualified personnel for other industries, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates		
	1985		
	Pessimistic	Optimistic	Average
Skilled workers	2 286	3 771	3 029
Construction workers	90	148	119
Mechanics and electricians	700	1 154	927
Transportation vehicle workers	129	213	171
Other	1 367	1 812	2 256
Office clerks	386	2 256	1 812
Total	2 672	4 408	3 540

Source: Mexico 1982

Table A.7.17: Accumulated demand for university graduates for fertilizers, Lazaro Cardenas, Mich.(at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Sciences and engineering	49	51	50	49	51	50
Civil eng.	1	1	1	1	1	1
Electrical eng.	2	2	2	2	2	2
Mechanical eng.	10	10	10	10	10	10
Chemical eng.	35	37	36	35	37	36
Other	1	1	1	1	1	1
Administration and accounting	9	9	9	9	9	9
Masters in administration	7	7	7	7	7	7
Accountant	2	2	2	2	2	2
Other	2	3	3	2	3	3
Total	2	3	3	2	3	3

Source: Mexico 1982

Table A.7.18: Accumulated demand for mid-level technicians for fertilizers, Lazaro Cardenas, Mich.(at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Technicians in	45	48	47	45	48	47
Mechanics	4	4	4	4	4	4
Electricity	3	3	3	3	3	3
Fertilizer production	25	26	26	25	26	26
Other	13	15	14	13	15	14
Administrative assistant	28	30	29	28	30	29
Accounting assistant	11	12	11	11	12	11
Administration assistant	17	18	18	17	18	18
Total	17	18	18	17	18	18

Source: Mexico 1982

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Table A.7.19: Accumulated demand for qualified personnel for fertilizers, Lazaro Cardenas, Mich.(at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Skilled workers	520	546	533	520	546	533
Construction workers	19	20	20	19	20	20
Mechanics and electricians	53	56	55	53	58	55
Transportation vehicles for workers	4	4	4	4	4	4
Fertilizer production workers	368	386	377	368	386	377
Other	76	80	77	76	78	77
Office clerks	8	8	8	8	8	8
Total	528	554	541	528	554	541

Source: Mexico 1982

Table A.7.20: Accumulated demand for university graduates at Conasupo, Lazaro Cardenas, Mich.(at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Sciences and engineering	---	---	---	10	12	11
Industrial eng.	---	---	---	3	4	4
Agronomics eng.	---	---	---	3	4	3
Other	---	---	---	4	4	4
Administration and accounting	---	---	---	21	25	23
Masters in administration	---	---	---	15	18	17
Accountant	---	---	---	6	7	6
Other	---	---	---	4	4	4
Total	---	---	---	4	4	4

Source: Mexico 1982

Table A.7.21: Accumulated demand for mid-level technicians at Conasupo, Lazaro Cardenas, Mich.(at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Technicians	---	---	---	9	10	10
Technicians in food industry	---	---	---	6	7	7
Other	---	---	---	3	3	3
Administrative assistants	---	---	---	29	33	30
Accounting assistant	---	---	---	8	9	9
Administrative assistant	---	---	---	21	24	21
Total	---	---	---	38	43	40

Source: Mexico 1982

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Table A.7.22: Accumulated demand for qualified personnel at Conasupo, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Skilled workers	-	-	-	382	439	410
Mechanics and electricians	-	-	-	28	32	30
Transportation vehicle workers	-	-	-	72	82	77
Food industry workers	-	-	-	261	301	281
Other	-	-	-	21	24	22
Office clerks	-	-	-	88	101	95
Total	-	-	-	470	540	505

Source: Mexico 1982

Table A.7.23: Accumulated demand for university graduates for administration and operation of the industrial port. Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Science and engineering	20	25	23	30	35	33
Civil eng.	5	6	5	7	9	8
Mechanical eng.	5	6	6	8	9	9
Industrial eng.	5	6	6	7	9	8
Other	5	7	6	8	8	8
Administration and accounting	30	35	32	40	50	45
Masters in administration	20	23	21	27	33	30
Accountant	10	12	11	13	17	15
Other	10	10	10	15	15	15
Total	60	70	65	85	100	93

Source: Mexico 1982

Table A.7.24: Accumulated demand for mid-level technicians for the administration and operation of the Industrial port, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Technicians	120	140	130	165	200	180
Civil eng.	5	6	5	7	8	8
Mechanics	5	6	5	7	8	8
Port admin. & operation	55	64	60	76	92	84
Customs	50	58	54	68	84	76
Foreign trade specialists	5	6	6	7	8	7
Administrative assistants	80	90	85	115	130	122
Accounting assistant	25	28	26	36	40	38
Administration assistant	55	62	59	79	90	84
Total	200	230	215	280	330	305

Source: Mexico 1982

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Table A.7.25: Accumulated demand for qualified personnel for the administration and operation of the industrial port, Lazaro Cardenas, Mich. (at constant productivity)

Occupations	Estimates					
	1982			1985		
	Pessimistic	Optimistic	Average	Pessimistic	Optimistic	Average
Skilled workers	440	520	480	640	740	690
Construction workers	15	18	17	22	25	23
Mechanics and electricians	10	12	11	15	17	16
Transportation vehicle workers	90	106	98	131	151	141
Winch and crane operators	75	89	82	109	126	118
Longshoremen	200	236	218	290	336	313
Seamen	30	23	21	29	34	32
Other	20	23	21	29	34	32
Office clerks	140	160	150	200	230	215
Total	580	680	630	840	970	905

Source: Mexico 1982

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The developing countries are having to contend simultaneously with problems and difficulties resulting from three revolutions, namely agrarian, industrial, scientific-technical and administrative. In these circumstances, the search for a solution is a complex task. The situation is further complicated by external factors, which do not favour the developing countries, e.g. the world economic and financial crisis, strained international relations, and the increasing dependence of developing countries.

A situation of this complexity calls for total mobilization and requires that every effort be made to profit from each opportunity and resource; it demands, moreover, that all those elements that might contribute to the solution of these problems be identified. How can education contribute to solving the problems of development, and in particular to those of industrialization and technical progress, and so help to guide a country of the importance and promise of Mexico along the road to economic independence? It is this fundamental question, asked here within the narrower framework of an industrial growth zone inside the country, which lies at the centre of this study prepared by Professor J. Padua of *El Colegio de Mexico* in association with Unesco's International Institute for Educational Planning.